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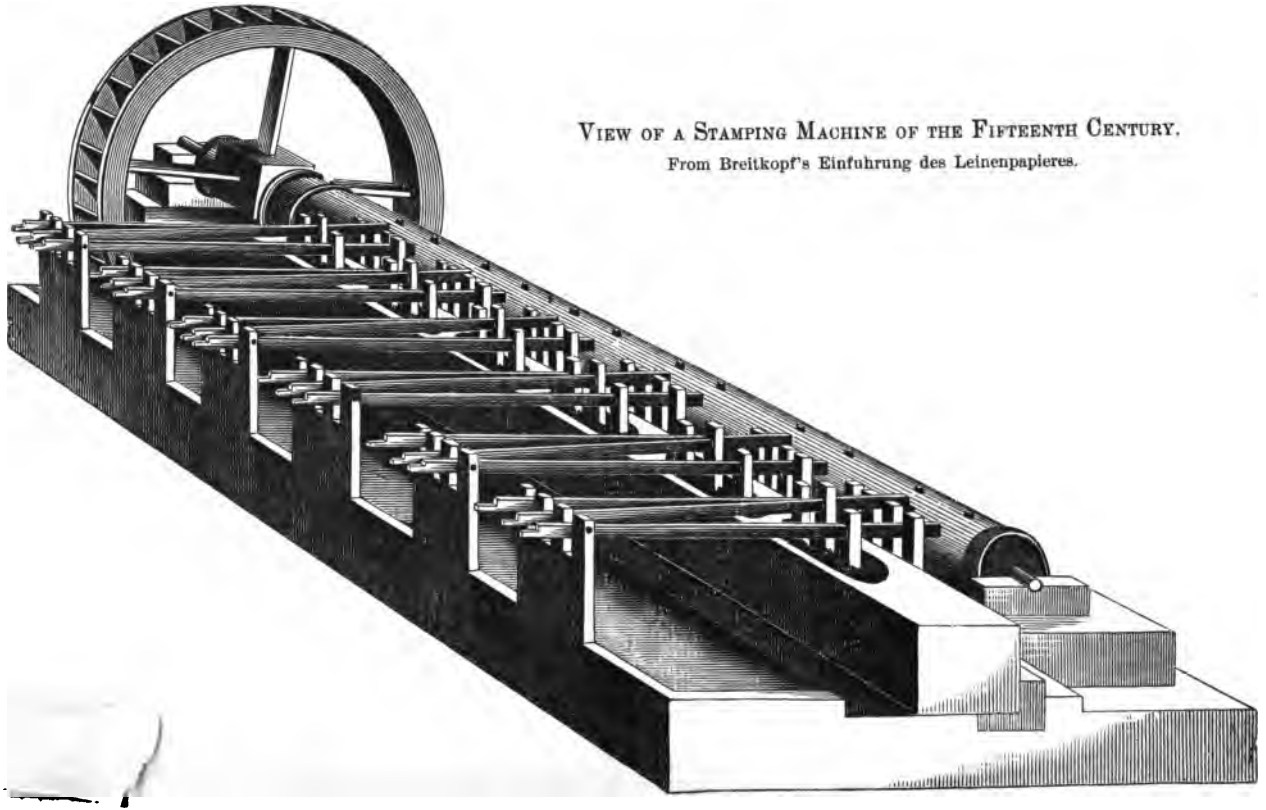
CHRONOLOGY

OF THE

ORIGIN AND PROGRESS

OF

PAPER AND PAPER-MAKING.



VIEW OF A STAMPING MACHINE OF THE FIFTEENTH CENTURY.

From Breitkopf's Einfuhrung des Leinenpapieres.

CHRONOLOGY

OF THE

ORIGIN AND PROGRESS

OF

PAPER AND PAPER-MAKING.

BY

JOEL MUNSELL.

FIFTH EDITION, WITH ADDITIONS.

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PREFACE.

THE facts embraced in the following pages have been gathered from so many sources, that it would materially encumber the work to give authorities. The valuable essay of Breitkopf,[1] published in 1784, and the interesting history of Matthias Koops,[2] who made extensive experiments in England in the beginning of the present century, have furnished numerous data. The *Jury Report* of the London Industrial Exhibition has been used to a considerable extent for more modern statistics of European countries. For the remainder, almost every available work has been consulted in English, French, German, and Nederdutch, and the newspapers. Upon the accuracy of the figures in the statistics here given it is impossible implicitly to rely,

[1] Versuch den Ursprung der Spielkarten, die Einfuehrung des Leinenpapieres, etc., Leipzig, 1784, 2 vols., 4to.

[2] Historical Account of the Substances which have been used to describe Events, and to convey Ideas, from the earliest Date to the Invention of Paper, London, 1801, 8vo.

especially upon such as have been gathered from the newspapers, where careful comparison is seldom given. The compiler has availed himself of whatever came under his observation that had the appearance of authenticity, but has not always had opportunity to verify dates and quantities.

It will be seen by the number of experiments made for the attainment of the same object by the same means in England and America especially, that paper-makers have had but little intercommunication, and there has long been great want of an American work, practical and experimental, on this most important art, which it is thought the eminent work of Mr. Hoffman has not wholly supplied. An account of the modes that have been pursued by the experimenters who have so long and arduously sought after a substitute for rags in the manufacture of paper, would of itself form an instructive volume. These experiments began in Europe more than a century ago, and were induced by the same cause which has ever since given rise to efforts in the same direction, the scarcity of rags. They have continually exercised the minds of manufacturers and others in this country during the present century, and the records of the patent office attest the fertility of invention which has been ex-

pended in this field of discovery. The list given in former editions of this work of substances which have been experimented upon, and of which it is claimed that paper has been produced of fair qualities, shows in a measure the extent of the effort which has been made to procure material to meet the increasing demand for paper fabrics; but they have now become so numerous, embracing almost everything in nature, that a repetition has been abandoned, as may well be done, since fish fibre has come in vogue, and sausages are cased in paper bladders, in place of animal intestines.

Not only have numerous patents been procured for useless modes of producing paper from various articles, for want of a knowledge of what had already been done in the same line, but costly machinery has in some cases been erected to assist in bringing them into use, after they had been experimented upon repeatedly and condemned. This will continue to be done until something is published on the subject in such a shape as to be accessible to the trade. It is hardly necessary to say that this work does not aim to supply the desideratum, yet to a considerable extent it will serve as an index to those experiments. It also indicates what has been done towards bringing machinery to perfection, while those efforts were being made to discover

new materials for paper stock. It is in this department that great results have been attained. In less than half a century, the machines have entirely superseded the diminutive hand-mills which sparsely dotted the country, and gigantic establishments have risen up in their places. Paper-mill villages, and banking institutions even, have grown out of this flourishing branch of industrial art, and we behold with satisfaction and amazement, what has been brought about by the aid of a commodity so insignificant in the eyes of the world as linen and cotton rags.

THE PAPYRUS PLANT.

INTRODUCTION.

ALL materials used for writing upon in early times were such as required but little mechanical fashioning to fit them for that purpose. Characters were engraved on flat stones made smooth, or were impressed in clay, which was afterwards dried or hardened by sun or fire, as in the Babylonian bricks. Thin boards of wood, covered with wax or a similar composition, and plates of ivory and metal, have been used; but a more convenient material was afforded by the leaves of certain species of trees. The skins and intestines of animals have also been made fit for writing upon; and there still exists in the Sorbonne at Paris a manuscript certified by an ancient librarian to be written upon human skin; and an elegant copy of the Bible which the Abbe Rive believed to be on the skin of a woman. When the Egyptian papyrus was introduced, all these things fell into disuse, except parchment, which is still preferred for certain purposes.

The first successful attempt to manufacture an article resembling modern paper, so far as we know, was made in Egypt at a very remote time. An

aquatic plant, known to us as papyrus, having a soft cellular flower-stem, afforded the material. The stem of the plant grew from ten to twenty feet high, of a triangular shape, from the thin coats or pellicles of which the paper was made. These were separated by means of a pin, or pointed muscle-shells, and spread on a table sprinkled with Nile water, in such a form as the size of the sheets required, and washed over with the same. On the first layer of these slips, a second was placed cross-wise, so as to form a sheet of convenient thickness, which, after being pressed and dried in the sun, was polished with a shell or other hard and smooth substance. Twenty sheets was the utmost that could be separated from one stalk, and those nearest the pith made the finest paper.

With respect to the time when this paper was invented, there are different opinions. Some authors have attempted to prove its antiquity from the earliest Greek writers; while Varro states that the invention was unknown in the time of Alexander the Great, about four hundred years before the Christian era. But Herodotus, who lived nearly a century earlier than Alexander, testifies that it was an article of commerce and a material for writing long before his time. The Romans at a later day improved upon the papyrus made by the Egyptians; they sized it in a similar manner to that pursued with rag-paper, making their size of the finest flour. The paper of the Romans was very white; that of the Egyptians of a yellowish or brown tinge.

The Egyptian paper was manufactured in Alexandria and other cities of Egypt in such large quantities that one individual boasted of the possession of so much paper that its revenue would maintain a numerous army. Alexandria was for a long time solely in the enjoyment of this manufacture, and acquired immense riches by it. Europe and Asia were supplied therefrom during several centuries. The commerce of Egyptian paper was flourishing in the third, and continued to the fifth century, when Theodoric abolished the impost upon it in Italy, where it was still used occasionally until the eleventh century; at which time the use of parchment, and paper made of cotton, superseded it.

The art of making paper from fibrous matter reduced to a pulp in water, appears to have been first discovered by the Chinese about eighteen hundred years ago. The Chinese paper is commonly supposed to be made of silk; but silk alone can not be reduced to a pulp suitable for making paper. Refuse silk is said to be occasionally used with other ingredients, but the greater part of the Chinese paper is made from the inner bark of the bamboo and mulberry tree, hempen rags, &c. The latter are prepared for paper by being cut and well washed in tanks. They are then bleached and dried; in twelve days they are converted into a pulp, which is then made into balls of about four pounds weight. These are afterwards saturated with water, and made into paper on a frame of fine reeds; and are dried by being pressed under large

stones. A second drying operation is performed by fastening the sheets on the walls of a room. The sheets are then coated with gum size, and polished with stones. They also make paper from cotton and linen rags, and a coarse yellow sort from rice straw, which is used for wrapping. They are enabled to make sheets of a large size, the mould on which the pulp is made into paper being sometimes ten or twelve feet long, and very wide, and managed by means of pulleys. The article popularly known as Chinese rice paper, is prepared from the pith of a plant, which is cut spirally into a thin slice, and when spread out and compressed, forms a light and fragile sheet, sometimes a foot in length, and five or six inches in breadth.

The Japanese prepare paper from the mulberry as follows: in the month of December the twigs are cut into lengths, not exceeding thirty inches, and put together in bundles. These fagots are then placed upright in a large vessel containing an alkaline ley, and boiled till the bark shrinks so as to allow about a half an inch of the wood to appear free at the top. After they are thus boiled, they are exposed to a cool atmosphere, when the bark is stripped from the wood and dried, and laid away for future use. When a sufficient quantity has been thus collected, it is soaked in water three or four days, when a blackish skin which covered it is scraped off. At the same time also the stronger bark, which is of a full year's growth, is separated from the thinner, which covered the younger branches, and which yields the best and whitest paper.

After it has been sufficiently cleansed out and separated, it must be boiled in a clear ley, and if stirred frequently, it soon becomes of a suitable nature.

It is then washed, a process requiring much attention and great skill and judgment; for, if it be not washed long enough, the paper, although strong and of good body, will be coarse and of little value; if washed too long, it will afford a white paper, but will be spongy and unfit for writing upon. Having been washed until it becomes a soft and woolly pulp, it is spread upon a table and beat fine with a mallet. It is then put into a tub with an infusion of rice and breni root, when the whole is stirred until the ingredients are thoroughly mixed in a mass of proper consistence. The moulds on which sheets are formed are made of reeds cut into narrow strips, instead of wire, and the process of dipping is like that of other countries. After being allowed to remain a short time in heaps, under a slight pressure, the sheets are exposed to the sun, by which they are properly dried. Among the remarkable uses to which they put the article of paper, may be mentioned that of water-proof clothing.

The ancient Mexicans also, were found to have a kind of paper prepared from the maguey plant, or American aloe, the product of which resembled the papyrus of the Egyptians, and took ink and color well.

The Arabians, in the seventh century, appear to have either discovered, or to have learned from the Chinese or Hindoos, quite likely from the latter, the art of

making paper from cotton; for it is known that a manufactory of such paper was established at Samarcand about the year 706 A.D. The Arabians seem to have carried the art to Spain, and to have there made paper from linen and hemp as well as from cotton.

The art of manufacturing paper from cotton is supposed to have found its way into Europe in the eleventh century. The first paper of that kind was made of raw cotton; but its manufacture was by the Arabians extended to old worn-out cotton, and even to the smallest pieces it is said. But as there are cotton-plants of various kinds, it was natural that they should produce papers of different qualities; and it was impossible to unite their woolly particles so firmly as to form a strong substantial paper, for want of sufficient skill and proper machinery, using, as they did, mortars and rude horse mills. The Greeks, it is said, made use of cotton paper before the Latins. It came into Germany through Venice, and was called Greek parchment.

The Moors, who were the paper-makers of Spain, having been expelled by the Spaniards, the latter, acquainted with water-mills, improved the manufacture so as to produce a paper from cotton nearly equal to that made of linen rags.

It is not known when cotton paper was introduced into England, but it appears that its use continued until the latter part of the fourteenth century, when it was gradually supplanted by linen paper, which began to be used in 1342.

Paper manufactures early became a very flourishing

product in France, and the paper-makers in that country soon excelled their neighbors in the art, and were therefore enabled to export considerable quantities, which increased so much yearly, that in 1658 two millions francs in value was exported to Holland alone; and it provided Spain, England, Switzerland, Denmark, Sweden, Russia, but chiefly Holland, and the Levant, with paper for printing and writing; and as late as the beginning of the present century twenty-five thousand reams were annually exported to Switzerland and Germany. But at this time the art of paper-making had arrived at a great degree of perfection in England and Holland, whereby the export from France was so much reduced, that, of four hundred paper-mills in two provinces, three hundred were discontinued.

Peter the Great, of Russia, visited the paper-mill at Dresden, in 1712, and was so much pleased with the art, that he engaged paper-makers whom he sent to Moscow, to establish a paper-mill at his own expense.

The first paper-mill of which we have found any account in America, was that of William Rittinghuysen, at Roxborough, near Philadelphia, in 1690, on a stream still called Paper-mill run.

In the manufacture of paper, any fibrous vegetable substance may be used. Wood and straw are much employed, but the process of manufacture was for a long time found too difficult and expensive, except for newspapers, and other coarse qualities.

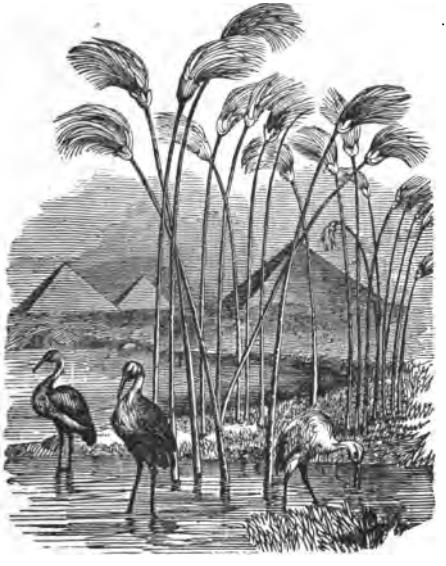
Although a French paper-maker claimed to have

obviated, by the aid of chemistry, all difficulties in the use of straw, and the experiments of Mr. Beardslee of Albany, were so far successful a few years since as to lead many to hope for an economical mode of converting the forests into paper to supply the all-devouring maw of the press, yet it is still thought that we shall never find anything to answer the purpose so well as linen and cotton rags. The Chinese employ a vast number of fibrous substances for this manufacture, and apply paper to a variety of uses little thought of in other countries. But if, as is foreshadowed, we come to construct houses and ships from this material, they will in turn wonder at us, no doubt.

In all kinds of paper-making, whether from the bark of trees or other fibrous matter, or from rags, the general process is the same. The fibrous material is cut and bruised in water till it is separated into fine and short filaments, and becomes a sort of pulp. This pulp is taken up in a thin and even layer upon a mould of wire-cloth, or something similar, which allows the water to drain off, but retains the fibrous matter, the filaments of which are, by the process of reduction to pulp, and subsequent drying and pressing, so interwoven and fitted together, that they cannot be separated without tearing, and thus form paper.

But the manufacture of paper, though an interesting process to witness, is difficult to describe intelligibly. Under the article Paper, the whole subject is briefly but comprehensively treated in Appleton's *American Cyclopedia*. Like the art of printing, paper

making has undergone a wonderful change within the last half century, calling into use immense steam and water power, and ponderous machinery, that consume the cast-off habiliments of the population of the whole world, and now require other material for consumption, to keep pace with the demand for their fabrics.



BABYLONIAN, OR CHALDEAN BRICK.

Mode of impressing characters in clay, on a cylinder, which was afterwards baked hard for preserving records.

CHRONOLOGY OF PAPER.

670 B.C. NUMA, who lived three hundred years before Alexander, left several works written upon papyrus, according to Pliny, which were still found at Rome a long time after his death, and is perhaps the earliest mention of the use of that substance. Unfortunately for the fact, the critics have *abolished* Numa.

600 B. C. Manufactories of Egyptian paper from papyrus, are supposed to have existed at Memphis. But papyrus manuscripts are found in the catacombs, apparently several thousand years old.

500 B. C. In Confucius's time the Chinese were innocent of ink and paper in the proper sense of the terms; their ink then being a sort of paint, their paper bamboo tablets, and their pen simply a short pointed stick.

440 B. C. Herodotus alludes to the general use of parchment among the Ionians at this time, under the term of sheep and goat skins.

300 B. C. For at least three hundred years before Christ, papyrus was exported in large quantities from Egypt.

270 B. C. The Jewish elders, by order of the high priest, carried a copy of the law to Ptolemy Philadelphus, in letters of gold upon skins, the pieces of which were so artfully united that the joinings did not appear.

216 B. C. Pliny expresses the opinion in his Natural History, XIX, 7, that spartum was first brought into Spain from Africa by the Carthaginians under Hannibal. Livy says that Hannibal stored vast quantities for various purposes.

200 B. C. A better method of dressing parchment was found at Pergamus about this time, which led to the supposition that parchment was invented there, and hence derived its name.

15 A. D. About this time, during the reign of Tiberius, a popular commotion arose in consequence of the scarcity of papyrus; the commerce in which had flourished a long time, but the supply seems to have been always less than the demand.

79. Herculaneum was overwhelmed, a city so obscure that very little account has been given of it by ancient writers; yet eighteen hundred manuscripts on papyrus have been taken from its ruins.

95. Du Halde says it was in this year that a mandarin of the palace manufactured paper of the bark of different trees, and old rags of silk and hemp. During this century they are said to have made sheets of paper ten or twelve feet long, of the inner bark of the bamboo.

280. The Japanese wrote upon silk faced with linen, and also used very thin wood shavings. About this time paper was first imported from the Corea, which superseded those fabrics.

284. The Romans sent to China a present of 30,000 sheets of strong brownish paper, made of tree bark. The Chinese are said to have improved upon the Roman hint, and subsequently brought their paper manufacture to a greatly improved state.

290. About this time the value of papyrus was so great that when Firmus, a rich and ambitious merchant striving at empire, conquered for a brief period the city of Alexandria, he boasted that he had seized as much paper and size as would support his whole army.

450. Proteaux says that a thick card or card-like paper came in use during the fifth century, when the manufacture of papyrus was declining.— De Vinne's *Invention of Printing*, p. 136.

500. About this time Theodoric abolished the duty on papyrus, which contributed to the revenue of the Roman empire, and fresh imposts had been laid upon it by successive rulers, until they became oppressive. Cassiodorus congratulates "the whole world on the repeal of the impost on an article so essentially necessary to the human race," "the general use of which," as Pliny says, "polishes and immortalizes man."

572. There is a manuscript in the British Museum, which appears to have been written at this time upon a roll of papyrus eight feet and a half long, and twelve inches wide. The longest specimen of papyrus known is the one at Paris, measuring thirty feet.

600. About this time paper made of bark was used by the Longobards, for the imperial protocols, in order to render the forging of diplomas more difficult.

610. Two priests were introduced into Japan from the Corea, to establish the manufacture of paper; but the fabric of the Coreans being imperfect, the use of mulberry bark was devised by Taishi, and became a most prosperous industry.

648. There was a manufactory of paper at Samarcand, similar to that which had long been made by the Chinese.

650. The Saracens having become masters of Egypt, the intercourse with Rome was so much interrupted that the supply of papyrus became scanty and precarious. Previously to that event, all public records had been executed on papyrus, while it is found that at a date immediately subsequent parchment was substituted.

704. The Arabians are supposed to have acquired the knowledge of making paper of cotton, by their conquests in Tartary.

706. Casiri, a Spanish author, attributes the invention of cotton paper to Joseph Amru, in this year, at Mecca; but it is well known that the Chinese and Persians were acquainted with its manufacture before this period.

900. The bulls of the popes in the eighth and ninth centuries were written upon cotton paper.

900. Montfaucon, who on account of his diligence and the extent of his researches is great authority, attempted to show that *charta bombycine*, cotton paper, was discovered in the empire of the east toward the end of the ninth or beginning of the tenth century. But see 706.

1007. The plenarium, or inventory, of the treasure of the church of Sandersheim, is written upon paper of cotton, bearing this date.

1049. The oldest manuscript in England written upon cotton paper, is in the Bodleian collection of the British Museum, having this date.

1050. The most ancient manuscript on cotton paper, that has been discovered in the Royal Library at Paris having a date, bears record of this year.

1085. The Christian successors of Moorish paper-makers at Toledo in Spain, worked the paper mills to better advantage than their predecessors. Instead of manufacturing paper of raw cotton, which is easily recognized by its yellowness and brittleness, they made it of rags, in moulds through which the water ran off; for this reason it was called *parchment cloth.*

1100. The *Aphorisms of Hippocrates*, in Arabic, the manuscript of which bears this date, has been pronounced the oldest specimen of linen paper that has come to light.

1100. Arabic manuscripts were at this time written on satin paper, and embellished with a quantity of ornamental work, painted in such gay and resplendent colors that the reader might behold his face reflected as if from a mirror.

1100. There was a diploma of Roger, king of Sicily, dated 1145, in which he says that he had renewed on parchment a charter that had been written on cotton paper in 1100.

1102. The king of Sicily appears to have accorded

a diploma to an ancient family of paper-makers who had established a manufactory in that island, where cotton was indigenous, and this has been thought to point to the origin of cotton paper, quite erroneously.

1120. Peter the Venerable, abbot of Clum, who flourished about this time, declared that paper from linen rags was in use in his day.

1150. Edrisi, who wrote at this time, tells us that the paper made at Xativa, an ancient city of Valencia, was excellent, and was exported to countries east and west.

1151. An Arabian author certifies that very fine white cotton paper was manufactured in Spain, and Cacim aben Hegi assures us that the best was made at Xativa. The Spaniards being acquainted with water-mills, improved upon the Moorish method of grinding the raw cotton and rags; and by stamping the latter in the mill, they produced a better pulp than from raw cotton, by which various sorts of paper were manufactured, nearly equal to those made from linen rags.

1153. Petrus Mauritius, who died in this year, has the following passage on paper in his *Treatise against the Jews:* "The books we read every day are made of sheep, goat, or calf skin; or of oriental plants, that is, the papyrus of Egypt; or of rags (*ex rasauris veterum pannorum*)," supposed to allude to modern paper.

1170. The time when papyrus wholly ceased to be used is not certainly known; but Eustathius, the scholiast on Homer, says it was disused before this time.

1178. A Treaty of peace between the kings of

Aragon and Castile, is the oldest specimen of linen paper used in Spain with a date. It is supposed that the Moors, on their settlement in Spain, where cotton was scarce, made paper of hemp and flax. The inventor of linen-rag paper, whoever he was, is entitled to the gratitude of posterity.

1200. Casiri positively affirms that there are manuscripts in the Escurial palace near Madrid, upon both cotton and hemp paper, written prior to this time.

1221. Frederic II of Germany, in consideration of the bad quality of paper made of cotton, its subjection to humidity, to alteration, and other defects, issued an order, nullifying all public acts which should be upon cotton paper, allowing two years to transcribe upon parchment all such as then existed.

1239. One of the earliest specimens of paper from linen rags, which has yet been discovered, is a document, with the seals preserved, of this date, and signed by Adolphus, count of Schaumburg. It is preserved in the university of Rinteln in Germany, and establishes the fact beyond dispute that linen paper was already in use in Germany.

1190. The oldest specimens of paper documents at Paris are said to be bonds given to Jews by the chiefs of Richard I of England, to aid the crusade of that monarch.

1270. By far the oldest manuscript written in France upon modern paper, is a letter from Joinville to St. Louis, which bears date a short time before the death of that monarch in 1270.

1270. Notwithstanding the most diligent search of the learned antiquary Montfaucon, both in France and Italy, he could find no book nor leaf of paper made of linen rags, before this year; whence it was concluded that there was no hope of finding an exact date to the invention.

1280. At this time very little use was made of Egyptian paper for diplomas, in England and Germany, but parchment was the universal substitute; and yet no map of parchment made before the sixth century is known to have been discovered.

1290. The first paper mill in Germany is said to have been constructed at Ravensburg. [Is this a misprint of Regensburg, now Ratisbon ?]

1308. Meerman satisfied himself that linen paper was used in Germany at this time, but was not able to decide in what country its invention originated.

1311. No other than Egyptian papyrus and cotton paper, it is asserted, was known in France before this time; although a letter is produced which is claimed to be linen paper, written before 1270. (See 1270.)

1314. The earliest undisputed French manuscript on linen paper is of this date, but it is not conclusive that it was fabricated in France.

1318. In Deutschland kommt leinenes Papier vor 1318 schwerlich vor; von diesem Jahre aber hat das Archiv des Hospitals Kauf beuern Urkunden auf lienenem Papier aufzuzeigen.— *Conversations-Lexikon.*

1319. Linen paper is said to have been found at Nuremberg by Von Murr of this date. (See 1342.)

1320. The earliest English manuscript on linen paper with a date that has been discovered is of the fourteenth year of Edward III.

1330. The construction of the first paper mill in Italy is placed in this year.

1330. Mr. Hunter, of the London Society of Antiquaries, could find no water mark in specimens of paper which he had investigated from 1302 to this date. His researches were among account books rendered to the English exchequer by officers employed in Aquitaine, and in the public archives of England, by which he determined that the earliest paper used was all foreign, and without any manufacturer's symbol. In a book of accounts of the constable of Bordeaux, of this date, he discovered the first mark, which was a ram's face.

1338. Peter II of Valencia, issued a command to the paper-makers at Valencia and Xativa, under pain of punishment, to manufacture better paper, which was to be equal to that formerly made; showing that the manufacture had degenerated.

1339. From a piece of very coarse cotton paper, bearing this date, in the possession of Meerman, who wrote about 1760, he argues that the art of paper-making was still neglected by the Spaniards, and that prior to the middle of the fourteenth century no linen paper had been manufactured in that country, yet the connoisseurs of Spain still persist in terming it linen paper.

1340. Tiraboschi, in his history of Italian literature,

places the establishment of paper-making at Padua in this year, deriving his authority from a passage of the ancient history of that city by Cortusius.

1340. Peignot says it was about this time that the manufacture of paper was established in France, in the neighborhood of Troyes and Essonne. Lombardy furnished paper to the French before this time.

1342. It has been claimed that the earliest manuscript in England on linen paper has the above date (see 1320). In the Cottonian Library of the British Museum, it is said there are several writings on this kind of paper, as early as the year 1335. Linen paper gradually supplanted that made of cotton.

1342. The Royal Society of Gottingen adjudged to John Daniel Fladd a prize medal of twenty-five ducats for the discovery of the most ancient linen paper, which bears this date. It is claimed that earlier specimens have been found. (See 1319.)

1350. There was a large manufactory of paper at Fabbriano in Italy, which, according to the description of Bartolus, had been long established, and enlarged from time to time, till it consisted of several mills belonging to different persons, although the whole formed only one manufactory of cotton paper.

1350. Although cotton paper was early introduced into Germany, and at the commencement of the ninth century was known under the name of Greek parchment, and although cotton and flax were spun and wove in that country in the tenth century, the manufacture of paper can not be traced beyond the middle

of the fourteenth century, when it was made by stamping mills.

1352. Date of a bill which reads thus: "To George Cosyn, for one quartern of royal paper, to make painters' patterns, 10*d.*"

1356. The first paper mill in Austria, established for producing paper from linen rags, was erected at Leesdorf, near Baden. This place now (1874), produces the best paper machines. [By a transposition of figures, apparently this date has been given as 1536.]

1360. Ulman Stromer began to write at Nuremberg the first work ever published on paper-making.

1360. The *Paper Trade Journal* of Jan. 15, 1874, states that the manufacture of paper in France was begun this year.

1366. The senate of Venice granted an exclusive privilege to the paper-mill at Treviso, that no linen-paper shavings or offal should be exported from Venice than for the use of that mill. This would seem to show that linen paper was already in use there.

1367. It is thought that there was no linen paper used in Italy before this time. The knowledge of cotton paper came by means of the Greeks to Italy; and the art of making it in Sicily, through the invasion of the Saracens.

1367. A document of a notary of this date proves the use of linen paper in Italy; and Maffei states that he possessed a family manuscript of linen paper of the same date, and he therefore attempts to appropriate the invention of linen paper to Italy.

1376. Du Cange cites the following lines from a French metrical romance written about this time, to show that waxen tablets continued to be occasionally used till a late period:

> Some with antiquated style
> In waxen tablets promptly write;
> Others with finer pen, the while
> Form letters lovelier to the sight.

There are many ample and authentic records of the royal household of France, of the thirteenth and fourteenth centuries, still preserved, written upon waxen tablets.

1377. A charter of this date, given at Fabbriano in Italy, relates to the lease of a mill with a waterfall, *ad faciendas cartas*. It was from the mills of this place that Bodoni, at the commencement of the present century, obtained the paper for his beautiful editions.

1390. Ulman Stromer established a large paper mill at Nuremberg, where were many Italian workmen. He employed *two rollers*, which set eighteen stampers in motion; but when he would add another roller, he was opposed by the Italians whom he employed, who would not consent to the enlarging of his manufacture; but they were imprisoned by the magistrates, when they submitted, renewing their oaths. He died in 1407. This is the first mill known to have been erected in Germany, which is said to have made the first paper from rags in Europe. But see 1350, 1366, etc.

1400. There were paper-mills at Colle in Tuscany, which were moved by water power.

1450. It is said that copies of the Bible printed upon parchment, by Gutenberg of this date, are found at Berlin, Brunswick, St. Blaise Monastery, and Paris, in three volumes, folio. This was possibly the first printed Bible, instead of the one known as the Mazarine Bible, of 2 vols.

1453. After the fall of Constantinople some Greeks established a manufactory at Basle, in Switzerland.

1468. An edict of Charles VIII attests that there were manufactories of paper at Troyes, Corbeil, and Essonne.

1470. We have the authority of the *Paper Trade Journal*, that the first paper mill in Switzerland was erected this year.

1471. Sweynheim and Pannartz, in a petition to the pope for assistance, informed him that the number of books they had printed and which remained on their hands was so great that he would admire how and where they could have procured a sufficient quantity of paper, or even rags, for such a number of volumes, which amounted to 12,475. This would probably have required about 1250 reams.

1498. An entry has been found in the privy purse expenses of Henry VII, as follows: "For a rewarde yeven at the paper mylne, 16*s.* 8*d.*," which establishes the fact that a paper mill preceded that of Spilman nearly a century, and was probably the mill mentioned below.

1498. In Wynken de Worde's edition *De Proprietatibus Rerum*, it is stated that the paper was made by John Tate the younger, in these quaint lines:

"And John Tate the younger Joye mote he broke,
Whiche late hathe in Englond doo make this paper thynne,
That now in our englyssh this book is prynted Inne."

This mill was at Hartford. The water-mark he used was an eight-pointed star within a double circle. A print of it is given in *Herbert's Typ. Antiquities*, i, 200.

1500. Paintings of this date by Julio Clavio, on parchment, are preserved in the Vatican. The art of painting on parchment was common before the art of painting with oil colors was discovered.

1514. John Tate died, who is supposed to have erected the first paper mill in England, about 1498.

1539. An ancient *water-mark* (erroneously so termed) of this era, consisted of a hand with a star at the fingers' ends, and is supposed to have given the name to what is still termed *hand paper*.

1539. A favorite paper-mark of this time was the jug or pot, and is supposed to have originated the term *pot paper*. The *fool's cap* was of a later date, and has given place in England to the figure of Britannia.

1540. About this time Henry VIII of England, in the wildness of his hatred of the pope, used for his correspondence a paper of which the water-mark was a hog with a mitre.

1552. Henry II of France exempted paper from all taxes and subsidies.

1558. Churchyard's *Spark of Friendship* was first printed this year, and mentions the paper mill of Spilman, which is often quoted as the first paper mill in England under the date of 1588, q. v. (See also 1498.)

1562. A work printed in this year mentions a paper mill at Fen Ditton, near Cambridge, England.

1564. Charles IX of France having put an impost upon paper, the university brought the subject before the parliament, when Montholon and De Thou advocated the abolition of the tax, and the university gained its cause.

1565. Charles IX of France, at the remonstrance of the university and the decision of the parliament, abolished the duty which he had laid upon paper.

1588. Nicholas, in his *Progresses of Queen Elizabeth*, gives a poem with the following title: *A Description and Playne Discourse of Paper, and the whole Benefitts that Paper brings, with Rehearsall, and setting foorth in Verse a Paper-myll built near Darthforth, by a high Germaine, called Master Spilman, Jeweller to the Queene's Majestie.* This is supposed to have been the second paper mill in England, and is often mentioned as the first. It was erected by a German named Spielman, or Spilman, in reward of which he received from Elizabeth the honor of knighthood. (See 1558.)

1591. A document in the Land Revenue Records of England, reads thus: "Fenclifton, Co. Cambridge; lease of a water mill called paper mills, late of the bishopric of Ely, to John George, dated 14th July, 34th Eliz." This is evidence of a third paper mill in England at this time.

1635. Under the reign of Louis XIII of France, an impost upon paper was established, but with the condition that the *fermier* should pay each year the sum of ten thousand livres to the royal printing office and the university of Paris.

1640. The manufacture of wall paper was begun about this time; as a substitute for the ancient *hangings* of tapestry, or cloth, they reached a high state of beauty and perfection.

1646. Athanasius Kircher, a Jesuit of the seventeenth century, boasted of having paper, among other things, made of asbestos.

1649. The water-mark of the finest English paper bore the royal arms. In order to show contempt for the king, Charles I, a fool with cap and bells was substituted for the arms, which gave the name of foolscap to the size of paper still bearing that name; and although those emblems have been taken from the paper, still the paper of the size which the parliament ordered for their journals bears the name and water-mark as an indignity to Charles I.

1652. Christina of Sweden having invited one of the Jansens from Holland as a printer, granted him the valuable privilege of importing all his paper duty free.

1654. Under Louis XIV, the indemnity established by his predecessor for the tax upon paper was changed to an exemption from duty of thirty thousand reams of paper, of all qualities and fabrics, of which the distribution was left to the superior of the university.

1655. There were at this early date 80 mills within a radius of six leagues around Angouleme, in France.

1658. The French paper makers produced fabrics so much superior to those of their neighbors, and their export trade had become so flourishing in consequence, that paper to the value of two millions of livres was this year sent to Holland; and they provided Spain, England, Switzerland, Denmark, Sweden, Russia, but chiefly Holland and the Levant, with paper for printing and writing.

1661. Fuller, writing of the paper of his time, says that it partook in some sort of the characters of the countries which made it; the Venetian being subtil, neat, and court-like; the French light, slight and slender, and the Dutch thick, corpulent and gross, sucking up the ink with the sponginess thereof. He complains that the English manufactories were not sufficiently encouraged, considering the vast amount expended for paper out of Italy, France, and Germany.

1663. England imported from Holland alone, paper to the amount of £100,000.

1670. Post paper seems to have derived its name from the post horn, which at one time was its distinguishing mark. It does not appear to have been used prior to the establishment of the general post office, here given, when it became the custom to blow a horn, to which circumstance its introduction is attributed.

1670. The manufacture of paper was still carried on with so little success in England, that the deficiency of that indispensable fabric was imported from the continent, and principally from France.

1678. At the end of a book with this date is the following singular advertisement: "To the king's most excellent majesty, this book is humbly presented, being printed upon English paper, and made within five miles of Windsor, by Eustace Burneby, Esquire, who was the first Englishman that brought it into England; attested by Henry Million, who was overseer in the making of this royal manufacture." (See 1498, 1558, 1588.)

1685. The first paper mill erected in Holland, according to a writer in the *Paper Trade Journal;* but the date seems to need investigation.

1685. Among the French refugees who went over to England, were a number of paper makers, who are supposed to have greatly improved the manufacture in the latter country.

1687. A proclamation was made for the establishment of a manufactory of white paper in England.

1688. It is stated in the *British Merchant*, that hardly any sort of paper except brown, was made in England previous to the revolution.

1689. Edmund Bohun says in his *Autobiography*, that "paper became so dear, that all printing stopped, almost, and the stationers did not care to undertake anything."

1690. Anderson states in his *History of Commerce* that it was in this year paper was first manufactured in England (see 1588); and that up to this time England imported paper from France to the amount of £100,000 yearly; but as the war with France occa-

sioned very high duties to be laid on foreign productions, some French protestant refugees settled in England, and introduced the manufacture of white writing paper.

1690. William Rittinghuysen, now spelled Rittenhouse, a native of Broich, in Holland, emigrated to America and was among the early settlers of Germantown, Pa. In the year 1690, he in company with Wm. Bradford, the printer, established a paper mill, the first in America, in Roxborough, near Philadelphia, on a stream called Paper-mill run, which empties into the Wissahickon, about two miles above its junction with the river Schuylkill. This mill supplied Bradford with paper while he lived in Philadelphia, and after he settled in New York. The paper was made from linen rags, the product of flax which was raised in the vicinity, and manufactured into wearing apparel.

1695. A company was formed in Scotland "for making white writing and printing paper," the articles of which are in the library of the British Museum.

1696. It appears by a document in the British Museum entitled the *Case of the Paper Traders*, that a bill was now pending for levying 20 per cent upon foreign paper, parchment, vellum, and pasteboard, and 20 per cent upon English paper, &c. It is also stated that there were not at this time one hundred paper mills in all England, and that the value of paper annually made was only about £28,000. It is further said that the paper makers were generally very poor and could scarce maintain their families.

1697. William Bradford leased his fourth part of the paper mill near Germantown, Pa., to William and Nicholas Rittenhouse, for a term of ten years, upon the following terms: that they should pay "y^e^ full quantity of seven ream of printing paper, two ream of good writing paper, and two ream of blue paper, yearly."

1700. Though several unsuccessful attempts had been made to introduce the manufacture of paper into Belgium, it was not until about this time that it became regularly established, by the aid of government; nor was its progress rapid during the eighteenth century.

1700. There were four hundred paper mills in the provinces of Perigord and Angoumois, in France; but the art of paper making had now attained such a degree of perfection in England and Holland, that the trade of these mills began to decline, and finally three-fourths of them were shut up.

1701. An effort was made in parliament to affix a tax upon cheap publications which had just come into vogue, yet the quantity of paper consumed by them was estimated at 20,000 reams a year.

1710. The second paper mill in America was erected in that part of Germantown, Pa., called Crefeld, on a small stream that emptied into the Wissahickon creek near the manor of Springfield, by William De Wees, a brother-in-law of Nicholas Rittenhouse, son of the first paper maker.

1711. The excise duty on paper was first imposed in England during the reign of Queen Anne, occa-

sioned by "the necessity of raising large supplies of money to carry on the present war." The necessity seems not to have ceased since.

1712. Peter the Great of Russia visited Dresden and witnessed the operation of paper making, with which he was so much pleased that he immediately engaged workmen to be sent to Moscow, where a mill was erected with great privileges.

1713. Thomas Watkin, a London stationer, revived the art of paper making in England, which had gone to decay; he brought it to great repute and perfection in a short time.

1716. John Bagford, the most extraordinary connoisseur of paper ever known, died in England. His skill was so great that it is said he could at first sight tell the place where and the time when, any paper was made, though at never so many years' distance. He prepared materials for a history of paper making, which are now in the British Museum, numbered 5891 to 5988.

1719. Reaumur, in an essay published at this time, seems to have been the first author who perceived that paper might be produced from wood. Observing that the fabric of wasps' nests was procured from wood, he took the hint, and explaining his own conceptions on the subject, desired that some one of those who had an opportunity should make the experiment.

1720. The kings of Spain having granted monopolizing privileges to many convents for the manufacture of paper, and when it came again into private hands,

fixed such a low price upon printed books, the trade went to decay. The Genoese, availing themselves of the opportunity, and procuring considerable quantities of rags from Andalusia, in this year sent back paper to Spain to the amount of 500,000 piasters.

1721. The quantity of paper manufactured in Great Britain annually was estimated at three hundred thousand reams, which was equal to about two-thirds of the whole consumption.

1723. The Dutch were importing large quantities of paper from France, there being few paper mills in Holland.

1723. The value of the paper annually made in Great Britain was estimated at £780,000.

1724. At a meeting of the legislative council of the state of New York, a bill was brought in from the assembly to encourage William Bradford and his assigns to make paper, and to prohibit all other persons from making the same in the province during the space of fifteen years, and desiring the concurrence of that board. On the 18th July the motion was put whether the said bill should be read a third time, and was negatived.

1727. Dr. Brueckmann, a German naturalist, published his work on stones, in which he treats of asbestos, and four copies of the book were printed on paper made of that material.

1728. William Demers and John Gorgas erected the third paper mill in Pennsylvania. They had been apprentices of Rittenhouse, and are said to have made

a paper resembling asses skin from a species of rotten stone, found in the vicinity, which was prepared for use by being thrown into the fire for a short time.

1728. A patent was granted by the general court of Massachusetts to a company for the sole purpose of manufacturing paper, for a term of ten years, on condition that in the first fifteen months they should make 115 reams of brown paper and 60 reams of printing paper; the second year 50 reams of writing paper in addition to the above; and the third year and afterwards yearly, 25 reams of a superior quality of writing paper in addition to the foregoing; and that the total annual produce of the various qualities should not be less than 500 reams a year.

1728. William Bradford owned a paper mill at Elizabethtown, N. J., which Thomas thinks was the first in that state.

1729. A paper mill was erected upon Chester creek, Delaware county, Pa., by Thomas Wilcox. The old mill was taken down in 1829. See 1853.

1730. The first paper mill in New England went into operation in Milton, Mass., under a patent granted two years before. It was carried on several years, and is supposed to have been discontinued for want of a workman. This was probably the paper mill of Daniel Henchman, an enterprising bookseller of Boston, who is said to have petitioned for and received some aid from the legislature of Massachusetts, and erected the first paper mill in that colony.

1731. Daniel Henchman, who with legislative aid

erected the first paper mill in Massachusetts, produced a sample of his paper before the general court.

1732. Richard Fry, stationer, bookseller, paper maker and rag merchant, in Cornhill, Boston, returned the public thanks for following the directions of his former advertisement encouraging the gathering of rags, and hoped they would continue the like method, having received upwards of seven thousand weight already.

1734. Seba, a Flemish writer on natural history, whose first volume was published this year, called attention to the fact that his country "does not seem to want trees fit for making paper, if people would give themselves the necessary trouble and expense. *Alga marina*, for example, which is composed of long, strong, viscous filaments, might it not be proper for this purpose, as well as the mats of Muscovy, if they were prepared as the Japanese make their timber?"

1746. The English had manufactures of *papiers peints* about this time, and more recently the Messrs. Potter erected at Manchester a colossal establishment, which by an ingenious machine printed four colors at a time, and which by the aid of eight machines, produced in a single day from 8 to 10,000 rolls, which was more than was produced by all the London manufactories.

1748. The decrease of exports of French paper from Rouen was so great that many of the mills were converted to other uses, principally to fulling mills.

1750. About this time the cylinder or engine mode

of comminuting rags into paper pulp appears to have been invented in Holland, but received very little attention abroad for several years after.

1750. It was in this year that Baskerville, to obviate the roughness of the laid paper of that time, had it made on wove moulds; his beautiful edition of Virgil (see 1757) was chiefly printed on this wove paper.

1751. Many suitable vegetables had been discovered, and schemes proposed for converting them into paper, as a substitute for rags, but none were carried into effect until now, when M. Guettard, in France, published his experiments and communicated new specimens of paper made from the bark, leaves, wood, &c., of different plants, shrubs and trees.

1754. Dutch workmen were brought into Austria at the public expense by the empress Maria Theresa, for the instruction of master paper makers; and the monopoly to buy rags was abolished.

1755. The Royal Society of Sciences at Gottingen offered a premium to trace the exact time of the discovery of the manufacture of paper from linen. (See 1763.)

1756. It has been noted that engines were not used in American mills before this time, but that rags were still reduced to pulp by being pounded.

1756. William Hutton opened the first paper warehouse in Manchester, England.

1756. The first attempt to manufacture paper of straw was now made in Germany, and was induced by the scarcity of rags. A treatise was printed on the

subject, giving a plan for reducing all vegetables into pulp, and bleaching the same.

1757. An edition of Virgil was printed by Baskerville in England, principally upon what the French term *papier velin*. It was an English invention, and this was the first work printed upon it.

1759. Until this period rags were reduced to pulp by means of stampers, a slow process, requiring considerable motive power; to remedy this, cylinders with sharp steel blades for tearing the rags (invented in Holland, where the wind-mills, then used for propelling machinery, were found inadequate to put these stampers in regular and constant motion), began to be used in other countries.

1760. The first paper mill in New England, supposed to have been stopped for want of a workman to carry it on, was revived by a citizen of Boston, who obtained for a British soldier stationed there, a furlough long enough to enable him to put the mill in operation.

1760. The making of paper in England had scarcely reached any high degree of perfection until this time, when the celebrated James Whatman established his reputation at Maidstone. He had visited the most celebrated paper mills in Europe, which enabled him to acquire a great celebrity in his profession, and his successors have maintained the reputation of the establishment to the present time; a medal having been awarded them at the World's fair in 1851.

1762. Gerardus Meerman, a Hollander, who wrote upon the origin of printing, offered a premium of

twenty-five ducats to discover the time of the first manufacture of linen paper. Specimens were sent to him from different countries, which were claimed to be linen; but all his researches were lost and reduced to an uncertainty, through the existing remnants of cotton paper, which was in use some centuries before linen, because the two are in many respects similar, and cotton and linen rags may have been at first mixed; it was therefore rendered more difficult to ascertain when the first paper was made from linen rags alone.

1763. The Royal Society of Science of Gottingen renewed their premiums of 1755 for the discovery of the period of the introduction of paper.

1765. Jacob Christian Schaffers, of Ratisbon, published a work in octavo, upon the different sorts of paper which he could make without the use of rags, giving specimens, among which were the coton du peuplier, hornets' nests, sawdust, moss, beech, willow, aspen, mulberry, clematite, and pine; with hop vines, the peelings of grape vines, hemp, the leaves of aloes, and lily of the valley; with arroche, mothwort, masse d'eau, barley straw, cabbage stumps, thistle stalks, burdock, conferva, wheat straw, broom corn, and Bavarian peat. (See 1772.)

1768. Christopher Leffingwell began to make paper at Norwich, Connecticut, about this time, and was encouraged by the legislature with the promise of a bounty.

1768. Such was the reputation of the paper fabricated in Holland, that the French Academy of

Sciences, at Paris, sent Demarets to that country for the purpose of visiting the mills, and studying the process.

1769. It was announced in the *Boston News Letter* that "the bellcart will go through Boston before the end of next month, to collect rags for the paper mill at Milton, when all people that will encourage the paper manufactory may dispose of them." The annexed lines were appended to aid the public zeal:

"Rags are as beauties, which concealed lie,
But when in paper how it charms the eye;
Pray save your rags, new beauties to discover,
For paper, truly, every one's a lover:
By the pen and press such knowledge is displayed,
As wouldn't exist if paper was not made.
Wisdom of things, mysterious, divine,
Illustriously doth on paper shine."

1770. Christopher Leffingwell, who manufactured paper at Norwich, Conn., under the official encouragement of 2*d.* a quire on all good writing paper, and 1*d.* a quire on all printing and common paper (see 1768), now received bounty on 4,020 quires of writing paper, and 10,600 quires of printing paper, after which the government patronage was withdrawn.

1770. There were eleven large paper mills in Holland in which wind mills were used to drive the cutting and grinding engines, which performed more labor in an hour than the German water mills with the stampers would do in six hours. In Saardam 1,000 persons were employed in paper making. They imported

nine-tenths of their stock; but exported great quantities of paper.

1770. In the states of Pennsylvania, New Jersey and Delaware, there were forty paper mills, which were supposed to make £100,000 worth of paper annually.

1772. There were two mills in operation in Italy for the manufacture of paper from maize, or Turkish wheat; but we have no account of their success, nor that the manufacture was more than an experiment.

1772. A book was printed in Germany, containing upwards of sixty specimens of paper, made of different materials, the result of one man's experiments alone. The author was Jacob Christian Schaffers,[1] and a copy is in the Smithsonian Institution library.

1774. Scheele discovered a gas now known as chlorine, which, in combination with lime, came to be employed in bleaching paper to a very great extent.

1775. There were, at the breaking out of the revolution, three small paper mills in Massachusetts; in New Hampshire none; and one in Rhode Island out of repair. The paper which these mills could make fell far short of the necessary supply. Paper, of course, was very scarce, and what could be procured was badly manufactured, not having more than half the requisite labor bestowed upon it. It was often taken from the mill wet and unsized. The people

[1] This work of Schaffers, *prediger zu Regensburg*, is entitled *Sammtliche Papierversuche.* It seems to have been the second work by this author on the subject (see 1765). Ratisbon is the more common name for the ancient city of Regensburg.

had not acquired the habit of saving rags, and stock for the manufacture of paper was obtained with great difficulty. Everything like rags was ground up together to make paper, which accounts for the peculiar colors often observed in the paper of this time.

1775. The Maryland convention resolved that the sum of 400 pounds, common money, be advanced to James Dorset, of Baltimore county, he giving bond with sufficient security to repay the same within two years, without interest, either in cash, or writing or cartridge paper, or in such proportions of each as this or a future convention, or council of safety, in their recess shall direct and order; that is to say: one-third part thereof within twelve months, and the other two-thirds within two years from the date of said bond; he at the same time engaging to build a mill for that purpose within six months from the date of his said contract; and to sell to the inhabitants of this province any kind of paper which he may make, as cheap as the same can or shall be sold at any mill in the province of Pennsylvania.

1775. The provincial congress of South Carolina offered a premium of £500 currency to the first person who should erect and establish a proper paper mill in that colony, upon producing three reams of good writing paper manufactured thereat.

1776. William Bellamy, having proposed to the provincial congress of South Carolina, that with some assistance from the public, he would erect and complete a proper mill for the making of paper and cutting

files at the same time, a committee was appointed to take his proposal into consideration.

1776. A volume was printed in France upon white looking paper, made from the bark of the linden (basswood), at the end of which were some twenty specimens of paper, made from as many different kinds of vegetables. But the poor quality of the fabrics and the cost of producing them seem to have discouraged the inventors.

1776. The Massachusetts house of representatives, in view of the scarcity of paper, resolved that the committees of correspondence, and inspection, and safety, in the several towns, be required to appoint some suitable person in each town to receive rags for the paper mills; and the inhabitants were desired to be very careful in saving even the smallest quantity of rags proper for making paper.

1776. Watson & Ledyard, having a paper mill at East Hartford, Ct., wholly supplied the press at Hartford, which published about 8,000 papers weekly, as well as the greater part of the writing paper used in Connecticut, and much of that used by the Continental army.

1776. Thomas Loosley and Thomas Elms applied to the New York Provincial congress to be exempted from military duty as indispensable to the successful pursuit of their business as paper makers. (4 *Force's American Archives*, vi, 615.) By a resolve of the convention Aug. 14, the master workman and two attendants at each paper mill were exempted.—5 *Ib.*, i, 1510.

1776. The Pennsylvania council of safety took measures to prevent the paper makers from joining the volunteers about to march to New Jersey, congress having resolved that they should be detained.

1777. The French Academy of Sciences sent a second deputation to Holland to visit the paper mills and learn the process by which their fine papers were produced.

1778. May 9, congress ordered $200 to be paid to Charles Cist and James Claypoole towards defraying their expenses, on their employment by the treasurer in superintending the making of paper for loan-office certificates and bills of exchange.

1778. When the American army entered Philadelphia, in June, upon the evacuation of the British troops, there was a want of paper fitted for the construction of cartridges. It was advertised for and but a small quantity procured. An order was then issued demanding its instant production by all people in that city who had it. This produced but little, and most probably on account of its scarcity. A file of soldiers was then ordered to make search for it in every place where any was likely to be found. Among other places visited in July, was a garret in the house in which Benjamin Franklin had previously had his printing office. Here was discovered about twenty-five hundred copies of a sermon which the Rev. Gilbert Tenant had written (printed by Franklin) upon *Defensive War*, to rouse the colonists during the French troubles. They were all taken and used as

cases for musket cartridges, and at once sent to the army, and most of them were used at the battle of Monmouth. The requisites in cartridge paper were, of course, thinness, strength, pliability, and inflammability, and such paper was necessarily scarce then.—*Historical Magazine*, viii, 151–2.

1779. M. Didot, the noted Parisian printer, having analyzed the vellum paper of the English, addressed a letter to M. Johannot d'Annonay, a French paper maker, inviting him to attempt a similar fabrication, which was successfully made by him. (See 1781.)

1779. There were ten paper mills in the neighborhood of Edinburgh.

1781. M. Didot, of Paris, having in 1779 encouraged M. Johannot d'Annonay to attempt an imitation of the English vellum paper, received from that manufacturer a quantity of the desired fabric, which procured for the latter a gold medal from the king, Louis XVI. It is known among the trade as *papier velin;* that is, like parchment, or without water-marks, as they are called.

1781. The scarcity of paper in New York at this time was so great that the journal of the second session of the assembly was not printed, the printer being unable to procure the necessary paper.

1781. Stockholm imported 18,579 reams of paper. The kingdom of Sweden had no more than twenty-four paper mills within its borders at a period about twenty years later.

1782. Hamburg imported 80,000 reams of paper.

The city had but two paper mills of two vats each, which consumed about 60,000 pounds of rags in making a dark purple paper for sugar bakers.

1784. The value of the paper manufactured in England was reported at £800,000, the excise on which was nearly £46,868.

1784. It was advertised in Albany that rags were wanted at the paper mill in Bennington, Vermont.

1785. According to Count Ewald von Hartzberg there were in the Russian dominions 800 (?) paper manufactories, the revenue from which was $200,000 annually.

1785. The legislature of Massachusetts passed an "Act imposing duties on licensed vellum, parchment, and paper." This was so unpopular that the same body found it necessary to repeal it.

1785. A gentleman who had directed his researches to national industry, stated that there were 400 paper mills in Germany, which furnished 20,000 bales, of ten reams each, per annum.

1786. The Society of Sciences at Philadelphia, Pa., offered a premium for the best remedy to protect paper against insects, and another for the best method of making paper for St. Domingo which would resist insects. Several answers and samples were received, all recommending to mix the size with sharp and bitter or other ingredients which might kill the insects. But they were all rejected.

1786. The works of the Marquis de Villette were printed in London in 24mo, on paper made of marsh

mallow; and at the end are specimens in single leaves of paper made of the nettle, hop, moss, reed, three species of conferva, couch grass, spindle tree, wayfaring tree, elm, lime, yellow willow, sallow willow, poplar, oak, burdock, coltsfoot, and thistle. These experiments were made at the manufactory of M. Leorier, at Bruges, and served to show that paper could be made of a multitude of articles; but they did not overcome the difficulty which existed, and which still exists, of disclosing a substance which should be preferable to linen and cotton rags.

1787. The consumption of French paper-hangings in the United States was so great, that the French government took off the export duty.

1787. A patent was granted to one Hooper, of London, for a new method of manufacturing printing paper, particularly designed for copperplate printing.

1788. Mr. Greaves, of Warrington, England, made paper from the bark and leaves of willow twigs.

1788. The Society for the Encouragement of Arts conferred a silver medal on a French manufacturer, for the production of forty-four quires of paper from the bark of the sallow tree. About 600 pounds of the raw material were used in the production of that quantity.

1789. The manufacture of paper in Angouleme gave employment to 600 workmen, who produced annually about 1,400,000 pounds. The beating was done with mallets, which was still in practice to a late day. The price of paper was about ten cents a pound.

1789. The paper mill nearest to Albany was at Bennington, Vt., which depended for stock upon the cast-off rags of the children of the wilderness. Paper was frequently brought from the mill in Springfield on horseback, and coarse and unbleached as it appears beside the poorest paper of our day, was of such value that it was customary to repair with paste the broken quires which always came with hand-made paper, so that no sheets were lost. There are several copies of the *Albany Register* preserved in a volume in the Albany Institute, which have undergone this process, and are so ingeniously done as not to be detected unless held up to the light.

1789. Homer, in his *Bibliotheca Americana*, informs us that at this time the people of North America manufactured their own paper, and in sufficient quantities for home consumption; but that the price of labor was so high as to discourage publishing beyond their own laws, pamphlets, and newspapers.

1789. Neuerdings versuchte Guttermann im *Serapeum* der Stadt Ravensburg in Wurtemberg, die Ehre der Erfindung des Leinenpapiers zuzuwenden.

1789. The celebrated *munitionnaire* Ouvrard, son of a paper dealer in France, perceiving that the revolution would give birth to a multitude of publications, contracted for all the paper which the manufactories at Poitou and Angoumois could produce in two years, by which he realized a hundred thousand crowns.

1789. Was sold in London, the completest specimen known to exist of manuscript written upon papyrus, dated 572 A.D.

1790. The paper makers of France labored themselves as the head-workmen of their establishments, assisted by their wives and children. This continued until the era of the introduction of machinery.

1790. The government of France, to cure the monopoly in paper, fixed by legislative act the price of all merchandise. It had the effect to stop all the mills.

1790. About this time the practice of blueing paper pulp had its origin. A paper maker's wife, superintending the washing of some fine linen, accidentally dropped her bag of powdered blue into the midst of some pulp in a forward state of preparation. The paper maker beheld in great astonishment a peculiar color in his pulp; which his wife, perceiving that no great damage had been done, took courage to disclose the cause of. Being pleased with an advance of four shillings a bundle upon his *improved* paper in the London market, he presented to his wife a costly cloak. [This fact is somewhat differently stated in the London *Printer's Register*, x, 71.]

1790. Samuel Hooper, of London, produced paper of various qualities from leather cuttings and refuse paper.

1790. The annual increase of printing presses in Germany, and the want of rags and paper stock, induced the manufacture of many more quires of paper from a hundred weight of rags than formerly, which rendered the German printing paper very disagreeable.

1792. A Mr. Campbell of England obtained a patent for a mode of bleaching rags for the manufac-

ture of paper. His process was similar to that pursued in bleaching cotton thread.— *Hansard*, 213.

1793. The first paper mill in the northern part of the state of New York was erected at Troy by Messrs. Websters, Ensign & Seymour, in which from five to ten reams were manufactured daily. An earnest appeal was made by the proprietors to the patriotism of the ladies, who were invoked to aid domestic manufactures by the preservation of rags. They were besought to patronize the saving of all kinds of linen and cotton rags, for which would be paid at the mill, 3*d.* for clean white, 2*d.* for white, blue, brown, and check, and a proportionate price for all other rags.— *Typographical Miscellany*, 97.

1794. A paper mill was built at Fairhaven, Vt., by Matthew Lyon, at which paper for wrapping was manufactured from the bark of the bass-wood tree.

1794. A patent was granted to Mr. Cunningham of Edinburgh for an improved method of making paper.

1795. John Bigg, of England, obtained a patent for a simple and effectual process of bleaching rags and other substances suitable for the manufacture of paper. It consisted in using manganese and sea-salt for the bleaching department, and also in the vat.

1796. A Mr. Bidds undertook the manufacture of paper from the saw-dust of sapwood, suitable for the purposes of printing [somewhere in England or America].

1798. Louis Robert, of France, a workman in the establishment of François Didot, at Essone, announced that he had discovered a way to make, with one man,

and without fire, by means of machines, sheets or paper of a very large size, even twelve feet wide and fifty feet long.

1798. The first paper mill in western Pennsylvania, called the Old Redstone mill, was built near Brownsville, on the Monongahela river.

1799. The largest paper mill in France was at Montargis, having thirty vats, requiring 1,620,000 pounds of rags, and 135,000 pounds of size. Another at Vougeot had twelve engines and twenty vats. The capacity of a mill in those times was computed by the number of vats it contained, handwork usually requiring a vat to each engine.

1799. The revenue from the excise duty on paper in England amounted to £140,000. The importation of rags from the continent was 7,307,117 pounds. It was estimated that twenty-four million pounds of rags were annually manufactured into paper.

1799. The first attempt to make paper in an endless web was successfully made in France by Louis Robert at the paper mill of François Didot, and a patent was procured for the same this year.

1799. Zenas Crane, of Worcester, Mass., journeyed a hundred miles, into Berkshire county, prospecting for a site on which to erect a mill of a capacity for the employment of five workmen, and selected a location on the south branch of the Housatonic, on premises belonging to Martin Chamberlain, in Dalton, where a mill was built; and which he afterwards sold to David Carson. These were the pioneers of the great paper interest in that region.

1800. Sometime during this or the previous year P. De Labigarre, who resided at Upper Red Hook, brought a bag of *frog-spittle* to the paper mill at Catskill, which was manufactured into a poor kind of paper. Several persons became interested in the experiment, and it was supposed by them to be a great discovery.— *Hist. Mag.*, III, 90.

1800. The first paper mill in Columbia county, New York, was transformed from a flour mill on the upper great fall of Stuyvesant falls, by Elisha Pitkin. Its capacity was one vat.

1800. The marquis of Salisbury presented to the king of England a book printed upon paper manufactured of straw, which treated of the manner in which the ancients employed different materials to perpetuate the remembrance of events before the invention of paper.

1800. Was printed by Burton, of London, an historical account of the substances which have been used to describe events, and to convey ideas, from the earliest date to the invention of paper; printed on the first useful paper manufactured only from straw.

1800. The duty on paper manufactured in England was £315,802.

1800. The government of France awarded Louis Robert, the inventor of the paper machine, 8000 francs, in consideration of the usefulness of his invention, and a patent for fifteen years; but the troubles in which France was involved caused delay in the necessary experiments, which were both tedious and

expensive, and permission was given to carry over the small working model to England, with a view of getting the benefit of British capital and mechanical skill to bring it into an operative state on a large scale.

1800. A successful experiment was carried out in England by Matthias Koops, by which 700 reams of clean and white paper were turned out weekly from such old waste and written and printed paper alone, as had previously been thrown away.

1800. A paper mill at Jaroslow, in Russia, with twenty-eight engines and seventy vats, manufactured 1100 reams of paper weekly, and consumed 800 tons of rags annually; there was another of thirteen engines and thirteen vats; they made paper-hangings principally for Moscow.

1800. There were upwards of 200 paper mills in Spain, of which thirty-one were at Alcoi, and it was said that one Francisco Guarro manufactured paper as good as any Dutch.

1801. M. Seguin, an inventor of some note, obtained a patent in France for the manufacture of paper from straw, hemp, and other vegetables, which he alleged produced an excellent quality of paper when prepared by his process; but this was so lengthy and expensive that it was not encouraged by paper makers.

1801. John Gamble, an Englishman, who had accompanied Leger Didot from Paris with Robert's invention for making an endless web of paper, obtained the first patent in England for that machine. Didot had agreed to pay Robert 25,000 francs for the patent and model.

1801. There were twenty-six paper mills in Russia, and notwithstanding the plenty of rags, the exportation of which was prohibited, they imported paper annually to the amount of 220,000 rubles.

1801. The number of paper mills in Germany proper was estimated to exceed 500, manufacturing two and a half million pounds of paper annually. But they made principally coarse paper, the finer qualities being imported.

1801. The paper mill of John Clark of Springfield, N. J., was burnt, with a large quantity of paper stock.

1801. Matthias Koops succeeded in making "the most perfect paper from straw, wood, and other vegetables, without the addition of any other known paper stuff." He printed a book on these fabrics, from which many of the facts here given have been gathered. He asserted that paper could be manufactured from any vegetable substance. He seems to have been the first to discover a mode of extracting printing and writing ink from waste paper, and obtained a patent for manufacturing paper from straw, hay, thistles, waste and refuse of hemp and flax, and different kinds of wood and bark, fit for printing and almost all other purposes for which paper is used. He claimed to have produced the first useful paper that had ever been made from straw alone.

1801. There were 500 paper mills in France, notwithstanding the diminution during a great number of years caused by the gradual decrease of export, arising from the activity with which the neighboring countries

pursued the manufacture at home. These mills were supposed to consume annually twenty million pounds of rags and coarse paper stuff; and that fourteen million pounds of rags were annually exported, notwithstanding the severe prohibition.

1801. Robert Bage, an English paper maker, died. William Hutton, the celebrated bookseller and author at Birmingham, purchased nearly all the paper which Bage made during forty-five years.

1801. Mr. David Buel, postmaster at Troy, New York, published the following homily under the head, "*Please to save your Rags.* The press contributes more to the diffusion of knowledge and information than any other medium; rags are the primary requisite in the manufacture of paper; and without paper the newspapers of our country, those cheap, useful and agreeable companions of the citizen and farmer, which in a political and moral view are of the highest national importance, must decline and be extinguished. The paper mills of the state, could the poor and the opulent, the farmer and the mechanic, be persuaded into the laudable frugality of saving rags, would turn out ample supplies of American paper to answer all demands. The people of Massachusetts and Connecticut, with true American zeal, have introduced this exemplary saving into the economy of their houses. The latter, by fair calculation, makes yearly a saving of rags to the actual amount of $50,000. The ladies in several of the large towns, display an elegant work bag, as part of the furniture of their parlors, in which every rag that is used in the paper mill, is carefully preserved.

Were this example imitated, this state would not be drained of its circulating cash, for paper and other manufactures, which American artists can furnish. The poor, by the mere saving of rags, may be enabled to procure paper and books, for schools and family use, or more agreeable articles of dress or consumption. The rich, who regard the interests of their country, will direct their children or domestics to place a bag or box in some convenient place, as a deposit for rags, that none may be lost, by being swept into the street or fire; the sales of which savings will reward the attention of the faithful servant, and encourage the prosperous habit of prudence and enterprise."

1802. A patent was secured in England by W. Plees for a mode of coloring paper pulp, which consisted of mixing with the pulp snuff, bran, hay, or any substance possessing the color which was desired to be imparted to the paper.

1802. Several patents were granted at this time in England and France, for improvements in the paper machine, most of which were of value, and caused more progression in the art than the substances offered for the production of paper.

1802. Burgess Allison and John Hawkins obtained a patent for making paper of the husks of Indian corn.

1802. M. Lozanna offered to the Society of Agriculture at Turin, a number of specimens of paper made of the *papus* of the *seratula ervensis*, the *carduus nutans*, and of the bark of the *erigerone* of Canada.

1802. The fourteen paper mills at Alsace in France,

which manufactured about 40,000 reams annually, exported about two-thirds thereof to Switzerland and Germany. The manufacturers in Languedoc, Lyons, Guienne, Bretagne, and Poitou, wrought also principally for exportation.

1803. Mr. Bryan Donkin, after nearly three years of intense application, succeeded in producing a self-acting machine on the plan of M. Robert of France. It was to him that Didot and Gamble, on their arrival in England, entrusted the attempt to construct the novel automaton. It performed in such a manner as to surprise every body, and he became universally celebrated as a manufacturer of paper machinery.

1803. The average yearly import of rags into Great Britain was 3,111 tons for this and the two previous years.

1803. In the cantons of Bern and Basil were several paper mills, which manufactured paper so much admired for its strength and whiteness, that it tended to diminish the importation from France.

1803. The magistrates of a northern town in England had the following notice painted on boards in large letters, and fixed up in all places of public resort.

"*To the Ladies.*— Genteel women, who amuse their idle hours in working, frequently throw scraps of linen and cotton of various kinds into the fire. It is requested most humbly, that every lady will reserve these trifles, and direct their maid servants to sell them, because their so doing will prevent £60,000 being annually exported to foreign countries for the import-

ation of old rags to make paper, and which in consequence, will become cheaper."

1804. About this time William Baily began the erection of a paper mill on the river Chateaugay, above the town of that name, in Franklin county, N. Y.; but it was never completed.

1804. Peignot estimated the quantity of printing paper consumed in Paris annually at 228,000 reams.

1804. The American Company of Booksellers offered a gold medal of the value of fifty dollars for the greatest quantity of paper, of the best quality fit for printing, not less than fifty reams, of other materials than linen, cotton or woolen rags; and a silver medal of the value of twenty dollars for the greatest quantity of wrapping paper, not less than forty reams, manufactured of other materials than those usually employed for that purpose.

1804. There was at this time a paper mill at Bellows Falls, owned by a Mr. Atkinson of New York and a Mr. Casey of Middletown.—*Ford's Ms. Journal.*

1804. Messrs. Henry and Sealy Fourdrinier, wealthy stationers and paper manufacturers of London, purchased the patents of Didot and Gamble in Robert's paper machine. It was by their improvements and extensive manufacture that the invention came to be called the Fourdrinier machine, by which it is still known, on both sides of the Atlantic. Their first experiments were made at Boxmoor, where they erected a machine and pursued their experiments at great expense.

1804. Mr. Donkin, since so celebrated as a paper machine maker, put up his second machine at Two Waters, in England, which was completely successful; and the manufacture of continuous paper became one of the most useful discoveries of the age.

1805. Mr. Donkin, the builder of the Fourdrinier paper machine, altered the position of the cylinders so as to dispense with the use of the upper web, an improvement by which the machine was much simplified (the paper on the web being slightly pressed before passing through the pressing rollers); thus an all-important advantage was attained. It was now capable of doing the work of six vats in twelve hours.[1]

1805. It was about this time that the *rice-paper* of the Chinese, used for artificial flowers, was introduced into England. It was an item of the gossip of the day that the princess Charlotte paid seventy guineas for a bouquet made of this paper, which is not a manufactured article, but a vegetable production, cut spirally, and afterwards flattened by pressure. It seems to have come from the island of Formosa originally.

1806. The first paper mill in Lee, Mass., was erected by Samuel Church, in this year.

1806. Francis Guy, of Baltimore, procured a patent for paper carpets, which he claimed were equal to canvas floor cloths, much more beautiful, and above fifty per cent cheaper.

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[1] By the hand process it took three months to complete the paper ready for delivery, from the time of receiving the rags into the mill; by the machine the paper may now be delivered the next day.

1806. The patentees of the Fourdrinier machine laid a statement before the public containing a comparative estimate of the expense attending seven vats, and that attending a machine employed upon paper sized in the engine, performing the same quantity of work as seven vats, at the rate of twelve hours a day. The expense of seven vats per annum was £2,604: 12*s.*; a machine doing seven vats' work was £734: 12*s.*; balance saved by the machine per annum, £1,870. The expense of making paper by hand at this time was 16*s.* per cwt.; by machine, 3*s.* 6*d.*

1806. The manufacturers at Angouleme first produced vellum-paper, which had been made in Holland since 1740, and at Annonay since 1781. An exhibition of manufactures was held at Paris, in this year, at which seven Angouleme manufacturers sent their products and obtained prizes.

1807. The paper mill of Nathan Benjamin at Catskill was burnt, with a stock valued at $9,000.

1807. Messrs. Fourdrinier stated before parliament that they had withdrawn from their stationery business the large sum of £60,000 to further the object of their enterprise; so many difficulties did they encounter, in bringing the machinery to its then comparatively complete state, and so little encouragement or support did they receive from the paper manufacturers throughout the kingdom. The prices of their machines were from £715 to £1040.

1807. Gen. Walter Martin, proprietor of the township of Martinsburg, Lewis county, N. Y., erected a

paper mill, which was run by John Clark & Co. They gave notice that rags would be received at the principal stores in Upper Canada and the Black river country, which (like many of the advertisements of the early paper makers, both in England and America), was accompanied by a poetic address to the ladies, one stanza of which ran thus:

"Sweet ladies, pray be not offended,
Nor mind the jest of sneering wags;
No harm, believe us, is intended,
When humbly we request your rags."

1807. The paper makers on the North Esk, in Scotland, made 681,000 pounds of paper during this year. See 1863.

1808. The Sultan Selim III was assassinated, and the printing office and paper manufactory which he had established a few years before, at Scutari, the Asiatic suburb of Constantinople, were destroyed.

1808. John Gamble, who had superintended the construction and improved the paper machine in England, after losing both his time and money-savings during eight years of irksome diligence, assigned over to Messrs. Fourdrinier, the whole right of his share in the patent to which he was entitled under the act of parliament, for improvements.

1808. Van Veghten & Son, who printed the *Western Budget* at Schenectady, issued their paper several weeks on a half sheet, alleging that they had posted to all the mills within thirty miles, without being able to procure a full supply, but only the promise of a

sufficient quantity within two or three weeks. They took occasion to request the ladies to pack up all their rags, and send them to the office, where they would be paid three cents a pound ready cash.

1808. S. & A. Hawley & Co. erected a mill at Moreau, near Fort Edward, New York, and their appeal to the ladies for their rags was larded with these forcible and unique blandishments:

"*Save your rags!* This exclamation is particularly addressed to the ladies, both young, old, and middle-aged, throughout the northern part of this state, by the subscribers, who have erected a paper mill in the town of Moreau, near Fort Edward — nor is it thought that this appeal to our fair countrywomen will prove unavailing when they reflect that without their assistance they cannot be supplied with the useful article of paper. If the necessary stock is denied paper mills, young maids must languish in vain for tender epistles from their respective swains; bachelors may be reduced to the necessity of a personal attendance upon the fair, when a written communication would be an excellent substitute. For clean cotton and linen rags of every color and description, matrons can be furnished with bibles, spectacles and snuff; mothers with grammars, spelling books and primers for their children; and young misses may be supplied with bonnets, ribbons and ear-rings, for the decoration of their persons (by means of which they may obtain husbands), or by sending them to the said mill they may receive the cash."

1808. The European Magazine for November desired porters and others who had in charge the sweeping of shops and public offices, not to burn nor destroy any coverings of letters, nor any other waste paper, printed or written, let the pieces be ever so small, as they could be remanufactured; and the saving of them would not only increase the quantity of paper, but be a handsome perquisite to themselves.

1808. It was stated that Rees's Encyclopedia printed in Philadelphia at this time, consumed 30,000 reams of paper. Considering the capacity of the mills at this time it is not easy to imagine how that quantity of paper was procurable.

1808. A paper mill was built at Watertown, N. Y., by Gurdon Caswell, from Oneida county; the first paper mill in the place. It was afterwards (1816) sold to Holbrook & Fessenden, of Brattleborough, Vt.—*Hough's Jefferson Co.*, 282.

1809. Mr. Dickinson, an English paper maker of note, invented another method of making endless paper, which competed with the Fourdrinier machine. Instead of the traveling wire-cloth, he conceived the plan of a polished, hollow, brass cylinder, perforated with holes, and covered with wire-cloth, which revolved over and in contact with the prepared pulp, sucking up the water by rarefaction, and leaving the filaments sufficiently strong to be carried by the usual process to completion.

1809. A paper mill was erected near the Schoharie bridge, New York, on the Great Western turnpike, by

Wood & Reddington, and was ready for operation in February.

1810. M. Didot having failed to fulfill his obligations to Louis Robert, in the purchase of the paper machine, the latter instituted a suit at law, and recovered his patent.

1810. The paper mills in Massachusetts were constructed for two vats each, and could make, of the various descriptions of paper, from two to three thousand reams per annum. Such a mill required a capital of $10,000, and employed twelve or more persons, consisting of men, boys and girls. Collecting rags and making paper gave an employment to not less than 2500 persons at this time. The quantity gathered of rags, old sails, ropes, junk, and other substances of which the various kinds of paper were made, was computed to amount to not less than 3500 tons yearly.

1810. Thomas estimated the number of paper mills in the United States at 185; of which seven were in New Hampshire, thirty-eight in Massachusetts, four in Rhode Island, seventeen in Connecticut, nine in Vermont, twelve in New York, four in Delaware, three in Maryland, four in Virginia, one in South Carolina, six in Kentucky, four in Tennessee, sixty in Pennsylvania; that they manufactured 50,000 reams of paper, averaging $3 a ream, and weighing about 500 tons; and 70,000 reams of cheap book paper, at $3.50, weighing 630 tons; 111,000 reams of writing paper at $3, about 650 tons; and 100,000 reams of wrapping at 83 cents; besides paper hangings and

a number of other articles sufficient for home consumption.

1810. The Chevalier Landolina died in Sicily, an antiquarian who maintained that the ancients used the pith of the papyrus for the purpose of making paper; and supported his opinion by ingenious experiments made with a plant growing near Syracuse in that country, and which corresponds to the description given by the ancients of the papyrus.

1810. The census returned 28 paper mills in the state of New York, which manufactured 77,756 reams of paper, the average value of which was $3 a ream.

1810. The second paper mill in Columbia county, N. Y., was erected at Stockport, on Kinderhook creek, by George Chittenden, whose sons continued its operation until the death of George junior, 1873.

1810. The United States began to import rags largely from Europe. Previous to this the materials for paper making were procured in the country.

1811. Edward Smith of London theorized on the production of paper from nettles and the threads of worn-out sacks; originating many valuable suggestions relative to the manufacture.

1811. Zenas Crane, who built the first paper mill in Dalton, Mass., long known as the Berkshire mill, sold to David Carson, and erected a new mill, at a lower fall on the same stream. These pioneers in a sequestered region, gave impetus to a manufacturing enterprise employing five hundred men in 1870. David Carson served his apprenticeship with Solomon Curtis at Newton, Mass. (see 1858).

1812. Gabriel Desetable, of Caen, in France, presented specimens of paper made from straw by means of an instrument said to be so simple that any person who pleased could make paper equal to the most practical workman.

1812. The number of paper mills in the United States was computed to be 190.

1813. Dr. Colquohoun estimated the value of paper annually produced in Great Britain at £2,000,000; but Mr. Stevenson, an incomparably better authority upon such subjects, estimated it at about half that sum.

1813. It was announced that a discovery had been made of a method of preparing paper, on which, by writing with water only, the impression would be as legible and durable as with ink. It soon proved to be unworthy of notice.

1813. A machine was patented in England for cutting waste paper, &c., into shreds, preparatory to remanufacture.

1813. The Fourdrinier machine was now so much simplified, that instead of five men formerly employed upon one machine, three were fully sufficient without requiring that degree of attention and skill which were formerly indispensable.

1814. Bertholet introduced a new mode of bleaching into the paper mills of France, and important progress was made.

1814. Alexander of Russia visited England, and engaged paper makers to go to Russia with machinery, where they built the great Peterhoff manufactory.

1814. It was estimated that there were 187 paper mills in the United States, which manufactured annually 340,000 reams of paper, valued at $820,000.

1815. The manufacturers of France began to devote their exertions to specialties; Annonay, Angouleme, l'Auvergne, les Vosges, and le Limosin, had each its peculiar style of product. This precluded much competition between different centres of production, and enabled each to arrive at greater perfection in its specialty.

1815. The first paper machine was constructed in France. Although the idea of producing an endless web of paper was first attempted to be carried out in that country sixteen years before (see 1799), strange enough, this was the Fourdrinier machine, invented by Louis Robert, which had been improved in England; but it was very imperfect when compared with an English machine imported about this time into France.

1816. It was a day's work, at this time, for three men to manufacture four thousand small sheets of paper by the hand process.

1816. The first paper mill established in the British American provinces, was built at Lackville, now Bedford, Nova Scotia, about eight miles from Halifax, on Nine-mile river. It belonged to Thomas Holland, who carried on a newspaper at Halifax. It was a one-vat mill, producing a brown paper.

1816. A paper mill went into operation at Pittsburg, Pa., with a steam engine of sixteen-horse power, on the principle of Oliver Evans, which employed

forty persons, consuming 10,000 bushels of coal and 120,000 pounds of rags per annum; and manufactured $20,000 worth of paper annually.

1816. Of a quantity of Bibles printed by the British and Foreign Bible Society, one was found two years later crumbling to dust, although it had not been used, owing to the process used in bleaching the paper at the mill.

1817. Thomas Amies, a noted paper maker of Philadelphia, produced a quantity of paper for the purpose of printing the *Declaration of Independence*, which was designed to surpass everything that had been attempted in that way in America. The mould and felts were got up expressly for the purpose, the size of the sheet was 26×36 inches, and nothing was used but the finest linen rags. Each ream weighed 140 pounds, and the price was $125.

1817. Thomas Gilpin & Co., paper manufacturers at Wilmington, Delaware, put in operation a machine for making paper, at their mill on the Brandywine, which appears by the notices of it to have been a cylinder machine, and an American invention. The first paper printed on the product of this machine, was *Poulson's Daily Advertiser*. It was stated that it would do the work of *ten paper vats*, and delivered a sheet of greater width than any other made in America, and of any length required.— *Eminent Philadelphians*, 411.

1817. Mr. Heath, an English pasteboard manufacturer, first introduced high glazing, now universally adopted; but for many years his process was unknown.

1817. E. B. Ball, an English paper maker, obtained a patent for making paper by the combination of new floss silk, flax, hemp, and Russia linen. These substances, under the usual process, were said to produce a white and durable paper.

1818. Roger Didot, formerly a paper maker in France, but at this time carrying on the business in England, obtained a patent for certain improvements upon the machine already in use for making wove and laid paper in continuous lengths or separate sheets.

1818. The *Prince of Wales Island Gazette* was printed on paper which was said to have been made from rice, by which was probably meant rice straw.

1818. The value of rags gathered in the United States was estimated at $900,000 per annum.

1818. A bill was brought before congress to increase the duties on certain articles manufactured in America; among which were, paper for copperplate printing, or writing, 12½ cts. a pound, and on all other papers 10 cts. a pound.

1818. The first paper machine at Berlin in Prussia.

1819. The London Society for the Encouragement of Arts and Manufactures, awarded 30 guineas to Mr. Finsley, for the invention of ivory paper, which was said to possess a surface having many of the properties of ivory, and at the same time the advantage of a much greater surface than ivory can possibly furnish.

1819. The paper mill of Simonds, Case & Co., in Farmington, near Canandaigua, N. Y., took fire from

a kettle of coals placed in the drying room to force the process of drying a lot of paper which had begun to mildew. Loss $5,000.

1820. Notwithstanding the great benefits derived by the perfection of the Fourdrinier paper machine and the immense quantity of paper produced by these machines, the old and tedious process of drying in lofts was still practiced.

1820. M. Huygeron, of France, secured a patent for making paper from pure straw. The invention related to a process of fabrication; however, a white and durable paper was the result of his improvements.

1820. About this time machinery for the manufacture of paper began to be introduced into the United States from England and France; but, being found expensive, was not much encouraged. It is believed to have been first used by Gilpin on the Brandywine.

1820. Solomon Stimpson, of Putney, Vt., advertised that he had discovered the art of making green paper for writing and printing, the utility of which was "to strengthen and preserve the eye."

1820. A patent was granted for five years by the government of Denmark, to the inventor of a mode of making paper from seaweed. It was claimed to be whiter and stronger than the paper in common use, and cheaper.

1820. The paper manufacturers of Baltimore petitioned congress for a tariff of 25 per cent on foreign paper. Congress was at this time using English paper, although the Gilpins on the Brandywine, with a capital

of half a million, were manufacturing paper which was claimed to be equally as good as the English, which they desired to furnish 25 per cent less.[1]

1820. The paper manufactures of the United States were estimated at an annual average of three millions of dollars; and the cost of materials and labor at two millions; employed 5000 persons, of which 1700 were males over 16 years of age, and the rest women and children.

1820. The paper makers of Pennsylvania and Delaware, petitioning congress for a tariff on paper, say that in their district there were 70 paper mills with 95 vats in operation until the importations after the war, since which they had been reduced to 17 vats. When paper was taxed, the amount paid by a vat was from $200 to $250. That these establishments cost about $500,000, and had employed 950 persons, consuming 2600 tons of rags, and producing paper to the amount of $800,000 annually.

1821. Fontenelle in France, manufactured paper from liquorice wood, by boiling — that is, by chemical process. [Query, if same as M. Janbeaurt.]

1821. M. Janbeaurt, an inventor, of Marseilles, obtained a patent in France for the production of paper from beaten hemp and liquorice wood, which were reduced to a pulp and prepared for paper in the usual manner.

[1] It is said in *Allen's Biog. Dictionary* that Simeon and Asa Butler, of Suffield, Ct., manufactured the first letter paper used in the senate of the United States, the product of this country.

1821. A very useful improvement was added to the paper machine by T. B. Crompton, of England, who obtained a patent for drying and finishing paper by means of a cloth against heated cylinders, and the application of a pair of shears to cut the paper off into suitable lengths, as it issued from the machine or rollers. The paper was much better finished and cut than had been found possible until this improvement.

1821. A paper mill containing two vats, was destroyed by fire at Esperance, Schoharie county, N. Y., owned by Henry W. Starin.

1821. England produced 48,204,927 pounds of paper.

1822. A flood of unprecedented violence in the Brandywine carried away the extensive paper mill of the Messrs. Gilpin, although the building in which their costly machinery was placed, had been erected, it was thought, beyond all possibility of danger from such a cause, and had been guarded by every precaution which anxiety and mechanical skill could suggest. The flood rose to the top of the building. For two days the whirling torrent swept along with fearful turbulence, and when the water at length subsided, the edifice itself was a mass of ruins. Buried beneath these, the fragments of machinery, broken into shapeless parts, could hardly be recognized, and the costly portions, framed with necessary delicacy and minuteness, had totally disappeared. The labor of years and the expenditure of thousands of dollars had vanished in a moment. Advanced in years, Mr. Gilpin looked

upon the wreck of his exertions and the injury to his fortune, with a certainty that he could not hope to replace what he had so suddenly lost.— *Eminent Philadelphians*, p. 411.

1822. The Philadelphia publishers consumed 30,000 reams of paper in printing Rees's *Cyclopedia*. It was the largest work in the English language.

1822. The paper makers united with the printers and booksellers in memorializing congress not to reduce the duty on imported books, stating that the cash value of books manufactured in this country was considerably more than a million of dollars annually (every article used in which was manufactured here), and a very important item, rags, of no value whatever, except for this purpose.

1822. John Ames of Springfield, Mass., produced a cylinder machine, which it was thought would have great success.

1822. An extensive paper mill on Bronx river, New York, owned by David Lydig, was destroyed by fire, with all the machinery and a large quantity of paper stock. It was insured for $32,000.

1823. A roll of papyrus measuring eleven inches in length and five in circumference was discovered in the island of Elephanta, in the East Indies. It contained a portion of the *Illiad* written in large capitals, such as were in use during the time of the Ptolemies and under the earlier Roman emperors.

1823. It was complained by the newspapers that congress was using paper with a French water mark, "*Napoleon empereur et roi*, 1813."

1823. There were 192 paper merchants in France.

1823. France possessed only one manufactory of the *papier continue*, that of M. Canson, at Annonay, who had one of the Fourdrinier machines, made in England.

1823. A manufactory of straw paper was established at Okainon, near Warsaw, by Asile Henrick, who proposed to make paper suitable for roofing, which should be fire and water proof. The finer qualities were expected to diminish the cost of paper.— *Revue Bib. du Pays Bas*, ii, 224.

1823. The paper makers of England were in the practice of using sulphate of lime and gypsum in the manufacture of paper to give it weight, to the extent of 12 per cent. This is the first complaint of the kind heard of.— *Hansard*, 232.

1823. It has been claimed that the first paper mill in Pittsburg, Penn., was built this year, but the fact has been questioned.

1823. A paper mill was erected in England for the purpose of manufacturing paper from old sacks, ropes, &c. The paper produced was used only for wrapping purposes.

1824. M. Laferet, of France, obtained a patent for making paper of beaten hemp, macerated in water. The Japanese macerate the same substance in lime-water.

1824. J. McGuaran patented in England a mode of producing paper from hop-vines, which was of a dusky-brown color, and employed for wrapping. The vines were immersed in water, by which the rind was

separated from the woody portion, when it was cut in small pieces and sent to the engine.

1824. A. Nesbit procured a patent in England for a mode of producing paper from moss, which afforded a pulp suitable for the manufacture of coarse paper.

1824. A beautiful paper was produced by the Japanese at this time from the mulberry tree, which was also of an excellent quality. It was prepared for manufacture in the usual manner.

1824. Louis Lambert, a Frenchman, took out a patent in England for certain improvements in the material and manufacture of paper. They consisted in reducing straw to pulp and extracting the coloring and other deleterious matter, so that it could be introduced into the ordinary rag engine, and employed in making paper.

1824. The Sieur Brepols, manufacturer of colored paper at Turnhout, in Belgium, produced in great perfection a style of paper which was termed *veau vacine* at from 80 to 100 francs per ream of *grand raisin* size.— *Rev. Bib. du Pays Bas*, iii, 128.

1825. A paper mill was erected at South Hadley falls on the Connecticut river, in Mass., which furnished newspaper of an inferior quality, for a paper at Greenfield, the other two papers there still using hand-made paper.

1825. William Van Houten, a Hollander, had a patent taken out in England, for a mode of manufacturing moss into paper and felt. He had patented the same in France a year earlier.

1825. One of the paper mills belonging to Messrs. T. & J. Gilpin, on the Brandywine, was destroyed by fire.

1825. Messrs. D. & J. Ames, Springfield, Mass., were said to have the most extensive paper manufactory in the United States; employing 12 engines, and more than 100 females, besides the requisite number of males. Their business was successful for a few years. They furnished paper for the temperance publications of E. C. Delavan; also for the first edition of Webster's quarto Dictionary, when their losses and misfortunes began.— *Paper Trade Journal*, May 1, 1874.

1825. Specimens of brown wrapping and bleached and unbleached writing papers were exhibited in Boston, which were manufactured in England from pine shavings. The fabric was said to be firmer than that of any paper manufactured from the ordinary materials.

1826. A letter from Paris states that "There is much talk here about a new sort of paper, made of hemp stock, which is to be so cheap that a handsome octavo volume of 420 pages, manufactured of it, may be sold for about 1*s.* 2½*d.* sterling.

1826. About this time a Mr. Sharp took out a patent in England for a mode of manufacturing paper of pine shavings. He had a mill at Hampshire.

1826. M. Canson, of France, applied to the Fourdrinier machine the principle of Mr. Dickinson, of England, of rarefying the air below the surface of

the web (see 1809), by means of suction pumps; an improvement which he kept secret for six years.

1826. Cappucius Brothers, paper makers of Turin, Italy, found the poplar and other kinds of wood well adapted for pulp, and on the report of the Academy of Sciences, of the excellent quality of the writing, printing and wrapping paper made of those woods, the king granted the makers an exclusive privilege for ten years for the manufacture of paper from ligneous materials.

1826. M. Firmin Didot introduced into his mill at Mesnil, the drying process invented by Mr. Crompton, of England, which was the first employment of it in France.

1826. The first machine for making paper that was put up in Denmark, was built this year by Messrs. Donkin, of England. The first paper-mill in that country had been established at Fredericksburg by order of Christian III.

1826. There were 80 printing offices in the city of Paris besides the government establishment, which consumed 280,800 reams of paper annually.

1827. Messrs. Canson Brothers, paper-makers of Annonay, in France, obtained a patent for a method of sizing paper. With respect to sizing machine-made paper, it is well known that sizing in the vat offers many advantages; but as a gelatine can not be employed without injury to the felt during the process of manufacturing paper, substitutes for gelatine were desirable. The base used by M. Canson was wax.

M. Delcambre in the same year made another, the base of which was rosin.

1827. A three story brick building, occupied as a store house for paper and rags at the South Hadley canal, on the Connecticut river, in Massachusetts, was accidentally burnt, 24th July, with most of its contents; damage upwards of $6,000.

1827. Mr. Obry conceived a plan of using alum and rosin previously dissolved in soda, and combining it with potato starch, for the purpose of sizing paper in the vat, which is the method now generally followed in France for writing and printing papers.

1827. MM. Firmin Didot Brothers and Lefevre established the first paper machine, under a patent of importation, in Sicily.

1827. White & Gale, of Vermont, obtained a patent for a mode of finishing paper.

1827. Louis Pierre Poisson, of Paris, obtained a patent in France, for a process of making paper of liquorice root and paste-board scraps; which were mixed together, macerated, and converted into paper in the usual manner.

1827. Pierre Balilliat, of Macon, in France, obtained a patent for a chemical substance to substitute for linen rags in the manufacture of paper.

1827. A patent was granted to the Count de la Garde, in England, for a method of making paper of various descriptions, from the bullen or ligneous parts obtained from certain textile plants, which were prepared by a rural mechanical brake; which sub-

stances were to be used alone in making paper, or mixed with other suitable articles, such as refuse paper and rags.

1827. Benjamin Devaux, of Paris, obtained a patent for a mode of making paper and pasteboard of hemp.

1827. The paper-mill of E. Peck & Co., of Rochester, N. Y., was destroyed by fire, with a quantity of paper and rags, Dec. 21: loss about $6,000, half insured.

1827. William Van Houten made experiments with moss, and succeeded in producing paper from it. He had taken out patents in England and France two years before. (See 1825.)

1827. There were but four paper machines in France, although one had been introduced there in 1815, and they had now been used in England about twenty-five years.

1827. William Magaw, of Meadville, Pa., obtained a patent for a mode of preparing hay, straw, or other vegetable substances, in the manufacture of paper; which was represented as being of a yellow color, but even and strong, and receiving the ink as well as common writing paper.

1828. Paper was made at Chambersburg, Pa., from straw and blue grass, according to a patent obtained by William Magaw. The paper was said to be firm and strong, and that machinery was being constructed sufficient to make 300 reams a day.

1828. It was estimated that the newspapers printed in New York consumed 15,000 reams of paper a year,

worth from four to five dollars a ream. And that the newspapers in the whole United States required 104,400 reams, the cost of which was $500,000.

1828. James Palmer, an English paper manufacturer, obtained a patent for the invention of certain improvements in the moulds, or other apparatus for making paper.

1828. George Dickinson, an English paper manufacturer, obtained a patent for improvements in paper-making machinery, which came into extensive use. The lateral shaking motion of the wire-web in the Fourdrinier machine, as originally made, was injurious to the fabric of the paper, by bringing its fibres more closely together breadthwise than lengthwise, thus tending to produce long ribs or thick streaks in its substance. This he proposed to obviate by giving a rapid up and down movement to the traveling web of pulp. A similar contrivance was introduced by Mr. Donkin, in which the vibrations were actuated in a much more mechanical way.

1828. Elisha Hayden Collier, of Plymouth county, Mass., obtained a patent for the invention of a mode of manufacturing paper from a marine production, called *ulva marina*.

1828. Moses Y. Beach, of Springfield, Mass., afterwards publisher of *The Sun* newspaper in New York, invented a machine for cutting rags in the manufacture of paper, for which he obtained a patent.

1828. Victor Odent, of Courtalin, in France, obtained a patent for a machine to manufacture paper with economy and ease.

1828. Prof. Cowper, of England, obtained a patent for a paper cutting machine. As other machines were introduced, his ingenious arrangement ceased to be used except as a model for others to improve upon.

1828. Richard Waterman and George W. Annis, of Providence, R. I., obtained a patent for a mode of making double paper. It consisted in bringing a sheet previously formed in contact with the stuff on the felt, and passing both between the press rollers. They claimed that any number of thicknesses might be treated in that way successfully.

1828. T. B. Crompton and Enoch Miller obtained a patent for cutting the endless web of paper lengthwise, by revolving circular blades, fixed upon a roller parallel to a cylinder, round which the paper was lapped, and progressively unwound.

1828. This 21st November, says Cobbett, I have not only received a parcel of paper made of the husks of my corn, but have sent it to have printed on it the title page of this very book. He alludes to his *Treatise on Corn*, an unique work on this account.

1828. April 16. The paper mill of Goss & Reed, at Montpelier, Vt., took fire while the workmen were at breakfast, and was damaged to the extent of about $3,000; partly insured.

1828. A paper mill was erected at Camden, Maine, by Ebenezer Barrett and John Swann, at a cost of $5,000. They manufactured $40 worth of paper a day. It was burnt in 1841.

1828. Cyprian Prosper Brard, of Frejus, in France,

obtained a patent for a mode of making paper from decayed wood, which was converted into pulp, and mixed with old waste paper.

1828. Mason Hunting, of Watertown, Mass., obtained a patent for an improved top-press roller, by means of which paper of any thickness might be made by a single and simple operation.

1828. A mode of sizing, glazing and beautifying paper was patented in England, which consisted of the use of a fluid compound of alkalies dissolved in water with beeswax and alum.

1828. A patent was taken out in France by Bernadotte and others, for a mode of making paper of animal substances, called aporentype.

1828. Marsden Haddock, of New York, obtained a patent for a machine to manufacture paper in the sheet by the dipping process. It seems to have been a mode of dipping faster than by the old hand process.

1829. William Debit, of East Hartford, Ct., obtained a patent for a machine for cleansing rags and preparing them for use in the manufacture of paper.

1829. Feb. A paper mill at Milton, Vt., owned by Ayres, and occupied by Wellington & Hunting, was totally consumed by fire at night. The loss was computed at $5,000, on which there was an insurance of $2,800.

1829. John Dickinson, an English paper manufacturer, obtained a patent for a new improvement in the method of manufacturing paper by machinery, and also a new method of cutting paper and other materials into

single sheets or pieces by means of machinery. He also announced an improvement in the manufacture of paper, which consisted of introducing cotton, flaxen, or silken thread, web, or lace, into the paper, in such a way as to form the inner part.

1829. John W. Cooper, of Washington township, obtained a patent for an improvement in the art of making white paper from rags of cotton, linen or silk, be their colors ever so various, and of extracting from all kinds of rags all kinds of mineral colors, &c., &c.

1829. Rondeaux & Henn patented in France a process of making paper from leather cuttings, mixed with refuse paper. (See 1790.)

1829. Messrs. Sprague, paper-makers at Fredonia, New York, obtained a patent for a mode of making paper from husks of Indian corn. Their process was, to 128 gallons of water, put 10 quarts of good lime, or 6 pounds of good alkalies, and 110 pounds of clean corn husks or flag leaves; heat over a moderate fire two hours, when they will be ready for the engine.

1829. Louis Bomeisler, of Philadelphia, obtained a patent for making from straw, white and handsome writing paper. From 120 pounds of straw, after the knobs were cut off, he claimed that he could produce 100 pounds of pulp, which would make fine, white and handsome writing paper, not before known or used.

1829. Isaac Saunderson, of Milton, Mass., obtained a patent for improvements in the cylinder machine, which obviated the defect of cylinder-made paper, the inequality of its strength when tried lengthwise and

across, in consequence of the greater number of fibres running in one direction than the other, and a consequent want of that perfect interlocking which takes place upon mould-made paper. To effect this improvement he introduced a horizontal whirl-wheel, and sheet-forming rollers, by which he was enabled to manufacture press papers, pasteboard, and bandbox paper.

1829. Reuben Fairchild, of Trumbull, Ct., obtained a patent for an improvement in the mode of manufacturing paper, the object of which was to obviate the defect in the paper made upon cylinder machines, in its being easily torn in one direction, in consequence of the fibres being mostly arranged longitudinally with the length of the sheet. The improvement was effected by what was called an agitator, a semi-cylindrical cradle of metal lying in the vat, and vibrating in the direction of the length of the cylinder. Culver & Cole, of Massachusetts, applied at the same time for a patent for a machine identical in principle with the above, but afterwards arranged a mutual ownership.

1829. The excise duty on paper in England amounted to £728,000.

1829. M. Julien obtained a patent in France for a mode of manufacturing paper from hay; also for a process of coloring paper.

1829. Paper was obtained from the maguey in Mexico, equal to that made of rags; and congress passed a law prohibiting the government from using any other paper.

1829. Quirini obtained a patent in France for the production of paper from straw and refuse pasteboard.

1829. The paper-makers of Turin, during this and the previous year, produced various qualities of paper from willow twigs, poplar, &c., which were extensively used. Schaffers had made the same experiment more than sixty years earlier. (See 1765, 1772.)

1829. The French paper makers sought for the Fourdrinier paper machine in England alone, and a French author makes the following painful acknowledgment for his countrymen: "La construction de ces machines, qui n'offre pourtant rien de difficile, est restée jusq'à ce jour exclusivement dans les mains des Anglaise."

1829. It is stated that a French paper machine was introduced into Windham, Conn., which is now used in the best mills in that state.

1829. Thomas Cobb, of England, obtained a patent for a mode of manufacturing tinted paper and embossing during the process of making, by pressing the pulp between rollers or plates, engraved with suitable devices. He claimed to have invented a mode of producing an embossed surface, giving a beautiful effect to papers colored in the pulp, and not stained after the paper is made, as usual with paper hangings; and by which also silks, velvets, or other colored goods could be put upon the surface of paper, and when embossed produced a rich and beautiful appearance.

1829. There were about 60 paper mills in Massachusetts, six of which had machines. They were all

supposed to consume about 1,700 tons of rags, &c., and produced about $700,000 worth of paper in a year.

1829. M. Montgolfier introduced a new fabric called *papier linge*, for table cloths and hangings, which was said to be as soft to the touch as the finest Silesian linen, but sold at Lyons for the price of mere paper. They were made in imitation of silk, or stamped with the most graceful *arabesques*, and sold at four and five sous the French yard.

1829. G. A. Shryock, of Philadelphia, claimed to have been the first in this or any other country, to manufacture by machinery, paper and boards from various kinds of straw and grass, which he did in this year upon a cylinder machine.

1829. Straw paper was used for packing *Niles's Weekly Register*, which circulated to the remotest parts of the country, and was regarded as the best paper then made for that purpose, and was cheap. It was manufactured at Chambersburg, Pa., at less than $2 a ream, imperial size, and was machine-made.

1829. It was estimated that the quantity of paper manufactured in the United States amounted to nearly seven millions of dollars, and employed more than ten thousand persons. The quantity of rags and paper-stock saved annually was computed to be two millions of dollars in value.

1830. A French writer states that at this time the English introduced a mode of sizing their paper, which gave it a great advantage over the French; that the house of Lacroix, however, soon acquired the process,

which was in vogue as long as the manufacture by hand was continued. It was about this time that the struggle began in competition with machinery, and the victory of the latter was not decided until some years, to such perfection had the hand process attained. The French seem to have introduced sizing before this time. (See 1827.)

1830. M. Brand, a French officer, made successful experiments in producing coarse paper from the pine tree, an account of which was published in the *Courier Francaise* of Nov. 27, 1830, issued in New York city.

1830. At Whitehall mill, in Derbyshire, England, a sheet of paper was manufactured which measured 13,800 feet in length, and 4 feet in breadth.

1830. At the custom house in London, a duty of £2,200 was levied on rags; £1,400 on superior kinds of papers for artists; and £701,000 upon paper.

1830. Wooster & Holmes of Meadville, Pa., obtained a patent for an improvement in the mode of making paper from wood, by which one hundred pounds of wood should be productive of from five to seven reams of paper, according to their estimates.

1830. Joseph E. Holmes and Lewis Wooster, of Ohio, manufactured paper of the lime and aspen, upon which an edition of the *Crawford Messenger* was printed. They also made wrapping paper and book-board of superior quality. They had a process of reducing wood to shavings with great rapidity. But Magaw, who had obtained a patent for making paper of "straw and other vegetable substances," claimed

that their use of alkalies was an infringement of his patent, and the process was abandoned.

1830. Richard Ibotson, of England, invented an apparatus for separating the knots from paper-stuff, which the sieves or strainers in use were inadequate to do effectually. It superseded the operation of picking the lumps from paper after it was made, which caused much damaged paper, and freed it from imperfections that caused serious damage to types and wood cuts.

1830. About this time Messrs. Phelps and Spafford, of Connecticut, succeeded in constructing paper machines which did good execution.

1830. Ephraim F. and Thomas Blank, of the city of New York, obtained a patent for a composition called leather paper. The art consisted of making paper from the refuse shavings or parings of leather, adapted to sheathing vessels. The process was the same as with rags.

1830. S. Aimes's paper mills near Philadelphia, were destroyed by fire (May 10).

1830. Mr. Sanderson, owner of a mill at Milton, Mass., manufactured binders' boards from three different kinds of salt grass, which grew in abundance near his mill; for which he obtained a patent.

1830. John Hall obtained a patent in England for a modification of Dickinson's cylinder-mould continuous paper machine, communicated to him by a foreigner. The leading feature of the invention was a mode of supplying the vat in which the wire cylinder is immersed, with a copious flow of water, for the

purpose of creating a considerable pressure upon the external surface of the cylinder, and thereby causing the fibres of the paper-pulp to adhere to the mould.

1830. John Wilks, an English machinist, improved the Fourdrinier machine by adding a perforated roller to facilitate the escape of the water from the pulp-web, previously to its being subjected to the pressing rollers, which was denominated a dandy.

1830. John Dickinson, of England, patented a mode of making paper in two layers or strata, which were brought together on the second cylinder, and formed into a single substance, a mode chiefly advantageous in producing thick paper.

1830. A patent was granted to Thomas & Woodcock, of Brattleborough, Vt., for an improvement in the manufacture of paper by means of a machine called a pulp-dresser.

1830. Thomas Gilpin, of Philadelphia, obtained a patent for an improvement in the mode of finishing paper, which consisted of calenders, or cylinders between which the paper passed to give it a polished surface.

1830. Thomas Barratt, an English paper maker, obtained a patent for inserting the water-mark and maker's name to continuous paper, so as to resemble in every respect paper made by hand. It is to this ingenious man that we are indebted for the improved means of finishing paper, owing to the perfection he attained in making cast iron rollers truer than was possible by the old mode of turning them in a lathe.

This consisted in grinding the rollers together, allowing merely a small stream of water to flow over them, without emery or any other grinding material; and by continuing the operation for many weeks, true cylinders were obtained. This is the mode now adopted in finishing rollers for all purposes requiring great accuracy.

1831. Jean Jaques Jaquier obtained a patent for making continuous paper with wire marks, similar to the laid papers usually made by hand; to which the preference was still given for their greater strength and peculiar appearance.

1831. Frederick A. Taft, of Dedham, Mass., patented an improvement in making pasteboard of other paper intended for sheathing.

1831. The Annsville paper mill, owned by Gen. Pierre Van Cortlandt, of Westchester Co., N. Y., and occupied by Mr. Ritter, was destroyed by fire on the 15th March, with a loss of $3,000, and no insurance.

1831. May 10. The steam paper mill at Cleveland, Ohio, occupied by J. Kellogg, was destroyed by fire. The loss was estimated at $7,000; no insurance.

1831. The *Franklin Repository*, printed at Chambersburg, Pa., announced that there was being erected in that borough, a mill house 150 feet long by 50 wide, and three stories high, in which it was contemplated to place eight machines, for the manufacture of straw paper, to go into operation the following spring.

1831. Edward Pine, of Troy, patented a machine

for cutting paper made by cylinder machines, while it was wet.

1831. George Carvil, of Manchester, Ct., obtained a patent for a mode of cleaning rags. His apparatus was a common screen, with or without pins and knives, having wings composed of thin pieces of wood or metal, affixed upon its outside, extending from end to end, in order to create a wind by their motion.

1831. An impetus was now given to the manufacture of paper in the United States, by the recent introduction of machinery, and changes in the mode of manufacture, as well as the materials used. Old junk, rope, hemp, tow, bagging, raw cotton, cotton waste, colored and filthy rags, and other material which had previously only been used in the making of coarser papers, were gradually brought into use for the finest grades, by the introduction of chlorine and other means of cleansing and bleaching, until they had risen 300 per cent in value.

1831. E. N. Fourdrinier invented a very ingenious apparatus for cutting the web of paper transversely into any desired lengths, which performed its duty well.

1831. Mr. Turner, an English paper-maker, obtained a patent for a peculiar strainer, designed to arrest the lumps mixed with the finer paper-pulp, whereby he could dispense with the usual vat and hog in which the pulp is agitated immediately before it is floated upon the endless wire web of the Fourdrinier apparatus. It could also be applied advantageously to hand paper machines.

1831. The *chiffonniers*, or rag collectors of Paris, rose against the police because it was ordered in certain municipal regulations, that the filth of the streets should be taken away in carts, without time being allowed for its examination by those diligent savers of capital.

1831. John Ames, of Springfield, Mass., introduced a wire cloth cylinder for carrying off the dirt and filth which is beaten from the rags in the engine, as a substitute for the screens or washers then in use.

1831. There were about 600 persons engaged in the manufacture of paper in Ireland.

1832. James Sawyer, of Newbury, Vt., took out a patent for a machine for cleansing paper, called the piston pulp-strainer, which differed in its mode of action from that of Thomas L. Woodcock.

1832. Francis Goucher, of Pennsylvania, made an improvement in the machinery for washing pulp, for which he took out a patent.

1832. April 14. The paper manufactory of Taft, in Dedham, Mass., was burnt.

1832. Samuel Foster, of Brattleborough, Vt., introduced a machine for cleaning and dusting rags.

1832. Nearly 12,000 quintals of paper were imported into Germany to supply the deficiency of its manufacture.

1832. Thomas French, of Ithaca, patented a filtering machine, which was designed to supersede the pulp-dresser.

1832. John Ames, of Springfield, Mass., obtained a patent for an improvement in the mode of sizing paper by machinery, and for a pulp-dresser.

1832. M. Goumar received a medal of 200 francs value for a mode of neutralizing the acid in paper used for lithographic work. He simply passed it through lime water.

1832. The excise duty on paper in England had increased nearly £100,000 in three years, being £815,000.

1832. It was said by the New York *Journal of Commerce*, that the improvements of paper machinery had been so great in five years, that though they used a sheet a quarter larger, it cost them a quarter less money.

1832. Henry Brewer, of England, modified the parallel rod-strainer of Mr. Ibotson, by constructing square boxes with gridiron bottoms, giving a powerful up-and-down vibration in the pulp-tub, by levers, rotary shafts and cranks.

1832. Joseph Amies, an English paper maker, improved the paper machine by a peculiar mode of constructing the bottom of a strainer or sieve for arresting the knots and lumps in pulp.

1832. Jarvis & French, of Tompkins county, N. Y., invented a mode of pressing paper by passing it between two hollow metallic rollers, which was used at the Falls Creek mill at Ithaca, by which the quality of the paper was improved and much labor saved.

1832. The manufacture of paper in the United States was estimated at $7,000,000 per annum, of which $3,500,000 was paid for rags, and $1,200,000 for labor. The price of paper had declined from 20

to 25 per cent, while the quality had advanced in about the same ratio.

1832. Coleman Sellers, of Philadelphia, obtained a patent for a pulp-dresser, for separating knobs and all gross articles from pulp.

1832. Mr. Towgood, of England, patented a paper-cutting machine, which dispensed with the reel and cut the paper as it came from the steam cylinders.

1832. Frederick A. Taft, of Dedham, Mass., obtained a patent for paper designed for covering buildings. He mixed finely ground coal and sulphur in the pulp, and added salt and lime to render it less combustible.

1832. Samuel E. Foster, of Brattleborough, Vt., patented a mode of cleansing paper makers' felts. They were passed over a perforated roller filled with water or steam.

1832. The paper mill erected at Martinsburg, N. Y. (see 1807), fell into ruin. It manufactured writing, wrapping and wall paper by the hand process, having no machinery but an engine for grinding.

1832. The first machinery for making paper, in Jefferson county, N. Y., was introduced this year by Knowlton & Rice, at Watertown, where they had commenced paper making about eight years before. Their mills were repeatedly burned.

1832. The paper made in the state of Connecticut was valued at $564,000 much of which was consumed in Hartford, then noted for its manufacture of books, in which it was surpassed only by Boston, New York and Philadelphia.

1832. The period of the manufacture of paper by hand in France now pretty much ceased, and the era of manufacture by machinery fully began.— *Paper Trade Journal*, July 15, 1875, p. 10.

1833. Henry Davy, of England, patented a rag-cutting and lacerating machine, the invention of a foreigner, consisting of an endless feeding cloth, which conducted the rough rags to a pair of feed rollers, on passing through which they were subjected to the operation of rotatory cutters; thence they passed down an inclined sieve, upon which they were agitated to separate the dust.

1833. Feb. The paper mill of Wiswall & Flagg in Exeter, N. H., was destroyed by fire with all its contents. The loss was estimated at more than $12,000, of which only $4,000 was insured.

1833. M. Tripot, of France, patented a process of manufacturing paper from seaweeds.

1833. A dinner was given by a Dublin printer to a large number of persons who had exerted themselves for the preservation of his premises from fire on a previous occasion, when the table was covered by a sheet of paper 125 feet long and 5 feet wide.

1833. Nov. 2. The paper mill of Messrs. Laflin, in Lee, Mass., was destroyed by fire, and $20,000 loss sustained.

1833. Paper was exported from France during this year to the amount of 5,323,261 francs in value; or, more than one million dollars.

1833. Howland & Griswold patented a mode of

applying the shearings or flocks of cloth, taken from the same in the manufacture thereof, for the purpose of covering the surfaces of paper, muslin, linen, leather and wood, for useful and ornamental purposes.

1833. Sydney A. Sweet, of Tyringham, Mass., invented a pulp-sifter, which was simply a sieve with a slight modification of similar machines.

1833. The *Penny Magazine* of the Society for the Diffusion of Useful Knowledge, in London, consumed 14,000 reams of paper a year. This required the constant working of two machines through the year. At the same time a paper mill with one machine was held to carry on a notable business, requiring the labor of forty workmen.

1833. Edmund Blake, of Alstead, N. H., invented an apparatus for sizing paper in the sheet, without handling it in the usual manner, thereby preventing the liability to tear, and facilitating the operation by sizing a much larger portion at once than could be done in the way ordinarily pursued.

1834. Of an edition of 30,000 copies of a book published in England in 1818, it was said that not a perfect copy existed; all of them having fallen to pieces owing to the process of excessive bleaching with chlorine, in manufacturing the paper.

1834. The quantity of paper annually manufactured in Great Britain during the five years ending with 1834, was 70,988,131 pounds.

1834. Clark Rice, of Watertown, N. Y., made an improvement in the washers for paper engines, which

consisted in the peculiar manner in which the vellum or wire cloth is kept free from rags or pulp, in the various stages of washing, and in which the egress of water is accomplished.

1834. A French inventor patented a mode of producing paper from the leaves of trees and the ligaments of asparagus. It was of no utility whatever.

1834. John Ames, of Springfield, Mass., invented an apparatus for cutting machine paper into sheets of any required length, as it comes from the drying cylinders. He at the same time patented machinery for cutting or trimming paper in the ream, which was said to have been an old and well known contrivance.

1834. Writing paper was introduced in England, which, by means of a chemical operation it underwent, became perfectly black where it was touched with a fluid. On writing with a pen dipped in water, a legible character was produced.

1834. Joseph Truman, of Bridgeport, Pa., conceived a mode of preventing the fibres, in the manufacture of paper, from arranging themselves in one direction, as they were inclined to do. He did not seem to know what had already been done to obviate that difficulty by the *agitator*.

1834. A book was published this year in Sweden, the paper of which was made entirely of beet root. The paper was strong and durable, but not of a fine texture, nor white in appearance. Paper was also manufactured in that country at the same time, of husks and of Russia matting.

1834. There were about a dozen paper machines in operation in France at this time, mostly constructed in England. They were henceforth to afford the only mode of manufacturing paper which could be pursued without loss; before which the ancient system of hand-work was rapidly to disappear.

1834. May. The paper mills at Newtown Lower Falls, owned by Lyons, were burnt. Loss estimated at $50,000.

1834. The net produce of the duty on first and second class paper in England this year was £718,043; of which only £101,023 was from second class paper.

1835. In November, the mills of Brown, Tower & Co., in Hampden, Me., were destroyed by fire; loss $20,000; no insurance.

1835. Paper was made in Ireland from peat, but was of inferior quality.

1835. Hayti exported 31,192 pounds of rags.

1835. William Debit, of Hartford, Ct., improved the common duster by a combination with it of a shaft and knives and beaters.

1835. The Thibetans had a process of reworking old paper made from the bark of the *sultarua*, which, however, was inferior to the paper of the Hindoos, made of the same material.

1835. The home duty on paper in England was recommended to be reduced one-half, and that it be fixed at 1½*d.* per pound on all descriptions of first and second class paper; and that the duties on pasteboard should be reduced in like manner; and that mill-

boards, glazed paper for clothiers, and hot-pressers, sheathing paper and button paper, and button-board, paying a duty of £1 1*s.* per cwt. should be placed on the same footing as pasteboard, and be subject to a like duty of 14*s.* per hundred weight.

1835. John Ames, of Springfield, Mass., took out a patent for an improvement in the machinery for manufacturing paper, which seems to have been the manner of applying a drying cylinder to the machines in use.

1835. The quantity of paper manufactured in England was 70,655,287 pounds, on which the government duty was £838,822.

1835. The royal printing office at Paris consumed about three hundred reams of paper a day, nearly a hundred thousand reams a year.

1835. There were 750 paper mills in operation in England, and the annual value of paper manufactured is stated by McCulloch as high as £6,000,000. Paper was burdened with an excise duty amounting to more than three times as much as the total wages of the workmen employed in making it, and the quantity annually produced did not exceed 50,000,000 pounds of first class, and 16,000,000 of second class paper, requiring a supply of about 100,000,000 pounds of rags.

1836. James Brown, of Esk Mills, near Edinburgh, adopted a new contrivance for rarefying the air under the web of the paper machine, by using a rectangular box transversely beneath the horizontal wire-cloth without the interposition of any perforated covering.

1836. Robert Rose's administrator, of East Hartford, Ct., patented an improvement in the paper machine, which consisted of a mode of sustaining the web of wire in a slanting position, so as to form the end and in part the bottom of the vat containing the stuff, which by draining through the web was properly deposited on the web for the formation of the paper.

1836. The quantity of paper charged with duties of excise in Great Britain was 82,145,287 pounds, and 8,032,577 yards of paper-hangings. The amount of duty was £812,782. Writing and printing paper, which had paid a duty of 3*d.* a pound, and the ordinary grades 1½*d.* since 1811, were now reduced to 1½*d.* for all grades.

1837. April 17. The paper mill of Peabody, Daniel & Co., at Franklin, N. H., was destroyed by fire. Loss $20,000; insurance $8,000.

1837. June 16. The paper mill of Carleton & Co., at Shirley, Mass., was destroyed by fire; loss estimated at $25,000; insured $16,000.

1837. The paper mill of Mr. Buddington, at Hotchkisstown, near New Haven, was destroyed by fire, Sept. 9; loss about $8,000.

1837. Edmund Shaw, of London, claimed to have made an improvement in the manufacture of paper, by the application of a certain vegetable substance not before used for that purpose. This was none other than the husks and stalks of Indian corn. He was aware that some attempts had been made to produce paper from these materials, and also that they

were abandoned because of the failure to produce good white paper from them.

1837. John Ames, of Springfield, Mass., patented a machine for sizing paper, without the use of feltings or jackets.

1838. The gross amount of paper-duty in Great Britain for the year, ending on the 5th January, was £554,497.

1838. J. V. Degrand, of London, obtained a patent for a certain pulpy product or material for the manufacture of paper and pasteboard. He claimed to use only white woods, such as poplars, and excluded every possible bark or epidermis.

1838. Homer Holland, Westfield, Mass., obtained a patent for preparing the fibrous portion of corn husks, so as to be a suitable base for paper. His patent was for a process of macerating the husks in a solution of carbonated alkali, and then rendering the alkali caustic by adding the hydrate of lime, leaving the fibre strong and capable of being perfectly bleached.

1838. M. De Breza, of Paris, invented a chemical compound for rendering paper and other substances indestructible by fire, and for preserving them from the ravages of insects.

1838. The paper mill of Messrs. R. L. Underhill & Co., at Urbana, N. Y., was destroyed by fire; loss $32,000; insurance $2,000. The owner of the building lost $4,000; insured $2,000. Mr. Underhill had been burnt out twice before within a twelve month.

1838. May 23. The paper mill of E. Camp in

Jefferson county, N. Y., was destroyed by fire. It was new and had been in operation but a short time. The loss was about $8,000; no insurance.

1838. June 22. The paper mill of A. Bradley & Sons in Dansville, N. Y., was burnt. It was nearly new, having been in operation but little more than a year, and cost $20,000 in its construction. There was an insurance of $10,500.

1838. The quantity of paper imported into the United States during this year was $164,179; the quantity exported $94,335. The import of rags was $465,448.

1839. The import of paper into the United States amounted to $186,418; the export was $80,146. The import of rags was $588,318.

1839. Henry Crosby, of London, obtained a patent for manufacturing paper from refuse tan (after it had been used for tanning, or any other purpose in which the fibre had not been destroyed), and hops. The latter substance was only used in combination with the tan (a species of bark) when it retained its fibre. These substances, when combined, were treated the same as rags. The claim of the invention was to the combination and products.

1839. Mr. T. B. Crompton, of England, succeeded in producing a uniform rarefaction under the wire-cloth of the paper machine, by means of a fan.

1839. At the French exhibition of this year were specimens of paper made of the leaves of the banana tree and similar plants, but the experiments showed

great waste in converting them into paper. With a view of reducing the cost of carriage by freeing the substances from foreign matter, M. Rocques established powerful works at Havana, to wash and convert them into pulp for the European markets; but even in this state the absolute necessity of strong bleaching caused a waste of more than one-third of the original weight.

1840. M. Brogniart of Paris seems to have been the first to call attention to the changes undergone by wood fibre when subjected to the influence of acids and alkalies; but his suggestions were not practically applied.

1840. The number of paper mills in England was computed to be 700; nearly 80 in Scotland, and an inconsiderable number in Ireland. About 27,000 individuals were supposed to be engaged in the trade in the United Kingdom, producing about £1,200,000 worth of paper.

1840. The paper mill of Phelps & Field, of Lee, Mass., was destroyed by fire, Nov. 27. But a small part of the machinery was saved; loss $20,000; insurance $15,000.

1840. Dec. 10. The Eagle paper mill of Peter Simmons, at Chatham, Columbia county, N. Y., was burnt, with all its contents.

1840. One-fifth of all the paper produced in the United States was made at Lee, Mass.

1840. There were 13 paper manufactories in New Hampshire, giving employment to 111 workmen, pro-

ducing $258,600 worth of paper annually, and having a capital of $104,300 invested.

1840. The development of paper-making in Russia is said scarcely to have taken place before this time (see 1785); that the Russians entered upon the fabrication of paper long after they had been engaged in other manufactures. (See 1712.)

1840. Lagrange Bull, of Martinique, made known the invention of a paper pulp which was manufactured from the leaves of the banana tree.

1840. The quantity of paper imported by the United States this year was $146,790; the export $76,957. The import of rags was $564,580.

1840. Nothing, says Dr. Ure, can place the advantage of the Fourdrinier machine in a stronger point of view than the fact of there being 280 of them now at work in the United Kingdom, making collectively 1,600 miles of paper, of from four to five feet broad, every day; that they have lowered the price of paper fifty per cent, and that they have increased the revenue, directly, and indirectly, by a sum of probably £400,000 per annum.

1841. The rags used in the manufacture of writing paper in Great Britain were collected at home. But those used in the manufacture of the best printing paper were imported principally from Italy, Hamburg, and the Austrian states, by the way of Trieste.

1841. Feb. 12. The paper mill of M. Safer, near Raleigh, N. C., was accidentally burnt. Loss $6,000.

1841. England produced 97,103,548 pounds of paper.

1841. March 10. The paper mill of Henry Church & Co., at Rochester, N. Y., was burnt.

1841. Barrett & Swann's paper mill at Camden, Me., was destroyed by fire.

1841. The United States imported paper this year to the amount of $60,193; and of rags $496,227. The export of paper was $83,483.

1842. Es gingen zwar noch ungefähr 10,000 Ctr. aller Gattungen, ganz abgesehen von den Papiertapeten, welche das Ausland noch zum grossen Theil liefert, ein, besonders nach Sachsen und Schlesien aus Böhmen, nach Baden aus der Schweiz, dafür aber auch über 12,000 Ctr. wieder aus.

1842. Der Zollverein besass 950 Fabriken für Papier, worunter mindestens 50 für Maschinenpapier; die Total production ist, da alle Anhalte fehlen, schwer zu berechnen, steigt aber alle Jahre, ohne der Consumtion vorauszueilen.

1842. March 3. The paper mill at Fall creek, Ithaca, owned by Mack, Andrus & Woodruff, was destroyed by fire; loss about $8,000, insured $8,100.

1842. According to an estimate made at a convention of paper makers in New York city, the machinery and paper mill property in the United States, were valued at $16,000,000 — the paper manufactured amounted to $15,000,000 per annum — the raw stock collected in the United States, to about $6,000,000 per annum, and the amount of stock

consumed at about 175,000,000 pounds. From fifty to sixty thousand persons were employed in the various operations connected with the trade for a livelihood.

1842. June 6. The paper mill of Charles Perham, Groton, Mass., was burnt. Loss $16,000; insured $8,000. The fire was occasioned by the friction of the machinery.

1842. Oct. The paper mill of William T. Parker, at Sudbury, Mass., was burnt.

1842. The importations of paper into the United States amounted to $92,771; and $468,230 of rags. The export of paper was $69,862.

1842. There were 356 paper machines employed in the mills of Great Britain and Ireland, having 372 vats.

1843. James Phelps, of West Sutton, Mass., made improvements in the washing machine, which consisted of an adjustable, rotating water elevator and strainer, which could be raised or lowered in the vat of the washing or beating engine. Also a rotating prismatic screen, or strainer, for straining the water from the paper-stock, in the vat of a washing or beating engine, in combination with devices for discharging the strained water, being not only more efficient than a cylindrical screen, but also admitting of more ready repair.

1843. The number of machines employed in the paper mills of England, Ireland and Scotland, was 367, requiring 362 vats.

1843. The English, although they made a sufficient quantity of most sorts of paper for their own use, and exported annually about £100,000 worth of books, still continued to import certain descriptions of paper for engravings, from France, and a small supply of paper-hangings; the duty on both of which amounted to about £2,800 a year.

1843. The United States imported paper amounting to $19, 997; and exported $51,391; the import of rags $79,853; a great diminution in the annual business of these articles, owing to the enforcement of a new duty upon rags, which affected the paper trade also.

1844. There were 600 [400?] paper mills in operation in the United States, giving active use to a capital of $16,000,000, manufacturing at least a sum equal to its capital per annum, and affording maintenance to at least 5,000 persons.

1844. Roberts's paper mill at Weston, Mass., was burnt. Loss $6,000; insured $1,000.

1844. October 28. The paper- mill of Messrs. Sharpless, Huskins, & Wallace, on Redstone creek, Fayette county, Pa., was destroyed by fire. Loss estimated at $20,000.

1844. The amount of paper imported into the United States was $104,648, and of rags $295,586. The export of paper was $83,108.

1844. The paper mills of England, Scotland and Ireland employed 370 machines, and 359 vats.

1844. One Keller took out letters patent in Ger-

many for a wood pulp grinding machine, and is claimed to have been the true inventor. Lacking capital to avail himself of the advantages of his discovery, he sold to Voelter, and subsequently fell into want, so that the German paper makers came to his relief by subscriptions.

1844. The German Zollverein imported annually about 8,000 thalers worth of gray blotting and packing paper, and exported papers of finer qualities, to the amount of more than 256,000 thalers.

1844. The Russian manufactory at Peterhof had been so much enlarged that it now turned at 70,000 reams a year, mostly fine papers.

1845. The quantity of rags consumed in the United States was estimated to amount to $6,000,000.

1845. There were 89 paper mills in Massachusetts, which consumed annually 15,886 tons of stock, producing 607,175 reams of paper, valued at $1,750,200, and employing 1,369 workmen.

1845. The amount of paper imported into the United States was $98,000; the export $106,190. The import of rags amounted to $421,080.

1845. The number of paper mills in Austria having machines was 40; the number working by the old process was 940. The total product was 314,000 quintals, selling at an average of 13 cents a pound. The number of persons employed was 12,000, besides rag-sorters.

1845. R. A. Brooman, of London, obtained a patent for producing paper from gutta percha, and an

intermixture of other substances. The fibre of the gutta percha tree is said to be very strong.

1845. The quantity of paper charged with duties of excise in the United Kingdom of Great Britain and Ireland, was 124,247,071 pounds. The exports amounted to 4,864,185 pounds.

1846. The import of paper into the United States this year was $194,220; of rags $385,397, being 3.89 cents per pound. The export of paper was $122,597.

1846. The Thuringian states of Germany had 41 paper mills, with 53 vats, and employing 274 persons.

1846. E. F. Vidocq, of Paris, secured a patent for obtaining paper, by the usual process, from a combination of leather cuttings, scraps, &c., hemp, cotton, wool, oakum, and other substances.

1846. There were in Prussia 394 paper mills, employing 6,393 workmen, and having 503 vats and 72 paper machines.

1846. Bavaria had 176 paper mills, with 257 vats and 11 machines, giving employment to 1,884 workmen.

1846. The number of paper mills in Saxony was 66, having 68 vats, and 6 machines, giving employment to 997 workmen.

1846. There were in the Grand Duchy of Hesse 21 paper mills, employing 170 workmen; having 18 vats and 1 paper machine.

1846. The electorate of Hesse, belonging to the Zollverein, had 28 paper mills, having 39 vats and 6 machines, giving employment to 299 workmen.

1846. Baden, in Germany, had 32 paper mills,

having 33 vats and 14 machines, and employing 624 workmen.

1846. Nassau, in Germany, employed 196 persons in the manufacture of paper; having 27 mills, with 30 vats and 6 machines.

1846. The annual imports of paper by the German Zollverein were upwards of 9,000 Prussian dollars; the exports $270,589. The exports were mostly fine papers, and the imports were of the coarser qualities.

1846. Genoa exported 1,178 tons of paper to Mexico, Spain, and the Brazils.

1846. The quantity of rags imported into the United States from all countries was 9,837,706 pounds, of which 8,002,865 pounds came from Italy. The aggregate value was $385,397, or 3.89 cents per pound. (See p. 99.)

1846. The quantity of paper manufactured in Great Britain and Ireland was 127,412,482 pounds, of which 4,836,556 pounds were exported. The paper mills of those countries employed 384 machines and 378 vats.

1846. There were 37 paper mills reported in the state of Connecticut.

1846. Dec. The Hollister paper mills, at Windsor Locks, Conn., were burnt. Loss $12,000; insured for $8,000.

1846. May 23. The paper mill of Mr. Craig at Fondasbush, Montgomery county, N. Y., was burnt. The loss was $4,000; insurance $1,000.

1847. Figuier and Poumarède, of Paris, invented

a kind of parchment paper, similar to that patented by Gaine in England, in 1857, q. v.

1847. August 6. David Ames died at Springfield, Mass., aged 87. He was a manufacturer of paper more than half a century, and was the first to introduce modern improvements. He was a man of great enterprise, for some time held the office of superintendent of the United States armory under the government, and was actively engaged in business until a very short period before his death.

1847. The quantity of paper manufactured in Great Britain and Ireland was 121,965,315 pounds, of which 5,852,979 pounds were exported. This gave employment to 405 machines, with 373 vats.

1847. Denmark imported about 300 tons of paper from Belgium, France, and other countries.

1847. The paper machine had been so universally introduced into all the new, as well as the old vat mills in the United States, that there were now only two mills of any note engaged in making paper by hand, and those were employed in producing particular sorts, requiring great strength and firmness.

1847. The Netherlands imported chiefly from Belgium and the Zollverein, 219 tons of paper valued at $7,167.60. The importation of rags was 700 pounds only. The exportation of paper the same year was 148 tons; principally to Java. The exportation of rags was only 1,200 pounds.

1847. There were 66 paper mills in the kingdom

of Saxony, with 6 machines, employing 992 persons. The exports and imports were trifling.

1847. The proprietors of the New Orleans *Bulletin* announced that they printed their paper on an article manufactured by themselves, at a mill in the third municipality, which they believed to be the only successful attempt to manufacture paper so far south.

1847. The quantity of paper manufactured in the United States at this time was computed at 18 millions of dollars in value per annum.

1847. Two paper mills were erected in Georgia this year, an event which the editor of the Savannah *Republican* remarked, that a few years before he despaired of living long enough to see.

1847. The quantity of rags imported into the United States this year was 8,154,886 pounds, of which 6,519,234 pounds came from Italy; the aggregate value was $304,216, being 3.73 cents per pound; of paper $195,571. The export of paper was $88,731.

1847. Herr Voelter, who availed himself of the wood-pulp grinding machine of Keller, having improved certain features of the process, and instituted the manufacture, now employed large quantities of the pulp for the manufacture of newspaper.

1847. The quantity of paper imported into Denmark this year was 334,000 kilogrammes, paying $13,020 duties.

1848. The import of rags from Denmark was 53,290 pounds, amounting to $1,614.

1848. The United States imported paper amounting to $415,668; and of rags $626,607. The quantity imported from all countries was 17,014,587 pounds, of which 13,803,036 pounds came from Italy; the average price per pound was 3.68 cents. The export of paper was $78,507.

1848. The quantity of paper manufactured in Great Britain and Ireland was 121,820,229 pounds, of which 5,180,286 pounds were exported. The number of machines employed was 407, with 367 vats.

1848. Zenas M. Crane, of Dalton, Mass., obtained a patent for an improvement in machinery for cutting paper. Patents were also obtained for the same purpose by George L. Wright, of Springfield, Mass.; by Mark Wilder, of Peterborough, N. H.; by J. C. Kneeland and George M. Phelps, of Troy, N. Y.; and Alonzo Gilman, of Troy, N. Y.

1848. The importation of paper in Hamburg was of the estimated value of $239,568.

1848. Sardinia produced paper which amounted in value to $2,400,000, none of which was exported.

1848. Spain exported 140,000 reams of paper, to the following countries: Cuba, 94,000 reams; Chili, 16,000 reams; Porto Rico, 10,000 reams; to other countries, 20,000 reams.

1848. March 21. The paper mill of Knowlton & Rice at Watertown, N. Y., was destroyed by fire.

1848. Leghorn exported rags and paper amounting to 30,000 pounds, about half to England, and the other half to the United States.

1849. There were 74 paper manufacturers in Belgium, employing 1,893 persons; 22 steam engines of 254 horse power in the aggregate; 2 horse mills of 2 horses each; 68 water mills, and 7 wind mills. The United States imported paper from Belgium amounting to 19,950 francs.

1849. W. Brindly obtained a patent in England for a mode of rendering paper water-proof. This was accomplished by saturating the web of paper as it passed from the machine, with linseed oil, and subjecting it to a high temperature until dried, by which it was rendered impervious to water.

1849. Grimpe & Colas, of France, invented paper for bank notes, which was intended to defy fraud and forgery. A committee of the Academy of Sciences had encouraged rival artists to make all possible experiments to test the infallibility of the paper, and no effort was spared to the accomplishment of that end, but without avail.

1849. An Englishman invented a method of spliting paper. The bank of England sent him a one pound note, much worn, to test his skill. He returned it in two sections.

1849. A. H. Laflin, who was the first to introduce machine laid paper into this country, at Herkimer, N. Y., in this year made the first laid note paper on a machine which was ordered by White & Sheffield.

1849. The United States imported paper this year to the amount of $395,773; and of rags $524,755.

The quantity imported from Italy was 11,009,668 lbs.; the aggregate quantity brought from all countries was 14,941,236 pounds, at an average of 2.51 cents. The exports were $86,827.

1849. The export of paper from Belgium amounted to £36,940.

1849. France exported paper-hangings to the United States, to the amount of 214,000 pounds; and imported upwards of 1,620,000 pounds of rags. The total export of paper was over 9,250,000 pounds.

1849. Messrs. Chambers, of Edinburgh, petitioned parliament for a removal or reduction of the excise duty on paper, which was especially severe on low-priced books.

1849. The importations of rags and other materials into Belgium for the manufacture of paper, amounted to only 14½ tons. Their exportations of paper were about $12,000.

1849. Amos & Clarke obtained a patent in England for a strainer used in the paper machine.

1849. The quantity of paper manufactured in Great Britain and Ireland was 132,132,660 pounds, of which 5,966,319 pounds were exported.

1849. Messrs. Amos & Clarke, of England, patented a paper-cutting machine, which obviated the difficulty that grew out of the increased velocity of the machines, by which the sheets were cut into irregular lengths.

1849. The number of paper machines employed in the mills of England, Scotland, and Ireland, was 406, with 353 vats.

1849. The exports of rags during this year from Trieste to the United States were $9,656.

1849. The first paper manufactory in France which adopted the wood-grinding process was that at Souche, in this year.

1850. The German Zollverein consumed annually, over 1,180,000 cwts. of rags in the manufacture of paper; employing 794 paper mills, having 116 paper machines, producing annually about 36,964 tons of paper.

1850. Henry Pohl, of Paterson, N. J., improved the regulator, or pulp meter, to measure the quantity of pulp for webs of different thicknesses.

1850. M. Didot stated that there were 200 paper machines in France, producing 195 tons each per year, making a total of 39,000 tons; and 250 vats, producing over 2,000 more tons per year; being a gross amount of 41,000 tons, of all kinds of paper. A paper machine occupied about 60 persons, and a vat 10.

1850. Nov. 23. The only paper mill in the District of Columbia, situated four miles above Georgetown, was destroyed by fire. Loss $2,000.

1850. The export of paper and stationery from the United States to foreign countries was not less than a hundred thousand dollars.

1850. The number of paper mills in England was 327; in Scotland, 51; in Ireland, 37. The number of beating engines in England was 1,374; in Scotland, 286; in Ireland, 86. The number of machines employed was 412, with 344 vats.

1850. A German by the name of Ebart, owning a large manufactory in Neustadt Elberwald, invented an incombustible and impermeable paper, which he termed stone paper, suitable for roofing houses, not easily broken, and capable of being produced at a low price.

1850. Specimens of paper were made in Algiers from the dwarf palm, which abounds in that country, and of which it was thought that four millions of quintals could be obtained every year, by causing it to be gathered by women and children, at a cost of about 18 cents a hundred pounds; which if beat into half stuff in its green state, would yield 36 per cent of its weight; and dry, 50 per cent: and that two hours beating would be sufficient to render this half stuff fit for making fine paper.

1850. The amount of capital employed in the manufacture of paper in the United States was estimated at 18 millions of dollars; the annual product of paper, 17 millions; the number of mills, 700; the number of operatives employed, 100,000. Another statement gives 443 mills, the product of which was estimated at $10,187,177.— *Paper Trade Reporter*, Sept. 1, 1873, p. 5.

1850. The quantity of paper charged with excise duty manufactured in Great Britain and Ireland, was 141,032,474 pounds.

1850. The amount of duty paid on paper in England was £693,741; in Scotland, £187,687; in Ireland, £44,096. The quantity of paper manufac-

tured in Great Britain and Ireland was 141,032,674 pounds, of which 7,762,686 pounds were exported.

1850. Great Britain imported 8,124 tons of rags, among which were 32 tons from the United States, and 23 tons from Egypt.

1850. The United States imported rags from nineteen countries. The quantity imported was 20,696,875 pounds at 3.61 cents a pound. Of these 15,861,266 pounds came from Italian and Austrian ports. The total value was $748,707. Paper was imported to the amount of $496,563.

1851. The quantity of paper manufactured in Great Britain and Ireland was 150,903,43 pounds, of which 8,305,590 pounds were exported. The number of machines employed in those countries was 413, with 330 vats.

1851. The United States imported rags of the value of $903,747, at 3.46 cents a pound. Of the 26,094,701 pounds imported, 18,512,673 were from Italy.

1851. There was exhibited at the World's fair in London, a roll of paper, being a continuous sheet 2,500 yards long.

1851. The export of paper and stationery from the United States was to the amount of $155,664 for the year ending June 30.

1851. It was estimated that there was produced at this time in Great Britain, 5,500,000 pieces of paper-hangings, valued at £400,000.

1851. In the kingdom of the Two Sicilies there

were 12 paper machines, and 12 vats, employing 300 persons. The whole produce amounted to 306 tons annually, and paper was exported to Rome, Sicily, Leghorn, Malta, the Ionian Isles, and Greece.

1851. Messrs. Donkin & Co., of England, who perfected the Fourdrinier paper machine, constructed their 191st machine. Of these 83 were made for Great Britian, 23 for France, 46 for Germany, 22 for the north of Europe, 14 for Italy and the south of Europe, 2 for America, and 1 for India. It was Mr. Bryan Donkin, who, as engineer, carried out the desired plans in perfecting the Fourdrinier machine, and produced, after intense application, a self-acting model, of which he afterwards constructed so many for home use and for exportation, which were perfectly successful in the manufacture of continuous paper.

1851. The quantity of paper produced in Austria was stated at 650,000 cwts. per annum. There were 900 vat-mills, and 49 mills using machines; two-fifths of the product of paper was from the latter, which were chiefly driven by water-power.

1851. Brewer & Smith, who had made improvements in paper moulds in England, patented the same in the United States.

1851. The paper mill belonging to the Goodman Manufacturing Company, at South Hadley, Mass., was destroyed by fire. The company had failed a short time before, involving a loss of $20,000.[1]

[1] The question has been propounded, if a paper company should fail for the want of anything but water or stock.

1851. There were 6 paper machines in operation in Denmark, besides one in Holstein, and 20 vats, producing altogether about 1,312 tons per year.

1851. There were five paper mills employing seven machines, in Sweden, and eight vat-mills.

1851. There were 17 paper machines in operation in Spain, which were imported from England, France, and Belgium; also 250 vats. The annual produce of paper was 4,741 tons.

1851. There were 12 paper machines and 60 vats in the kingdom of Sardinia.

1851. M. Adolphe Roque, who had bestowed many years of patient investigation on the improvement of the manufacture of paper, succeeded in adapting to that purpose the fibres of certain filaceous plants, especially the banana and the aloe, whereby it was expected that "the present costly, laborious, patchy, *rag* process might be superseded by a raw material easily procurable in large quantities, and safely and economically worked into a clear, strong and durable texture."

1851. The paper employed in the manufacture of books in Great Britain paid an excise of 14 guineas a ton, being about one-fifth the selling price of the article.

1851. Samples of paper made from alfa fibre were exhibited at the London exhibition, in the Algerian section of French products. The plant is abundant on both shores of the Mediterranean.

1851. At the great exhibition a huge sheet of

Nepal paper attracted attention, manufactured from a species of fibrous plants found in that country, by a process supposed to have been introduced from China.

1851. There were 20 paper mills in Tuscany, and 2 English machines at the mill near Florence.

1851. In Switzerland there were 26 paper machines and 40 vat-mills, producing together annually 11,607 tons. The wages of the men are about 16 cents a day, and of women about 11 cents. No paper was exported.

1851. There were six paper machines distributed among four mills in the Lombardo-Venetian kingdom of Italy.

1851. There were three paper machines in operation in the Roman states.

1851. There was a paper mill at Smyrna, having a machine, and a vat-mill at Constantinople, which was all the Turkish empire proper afforded.

1851. There was a paper mill in Egypt, at Boulac, near Cairo, which was a vat-mill. This mill belonged to the Khedive in 1873, and employed 155 persons at monthly wages, and 63 at task. Its annual product was 165,511 reams of paper for printing, etc., and 347 cwt. of wrapping.— *Paper Trade Journal*, p. 2, Jan. 15, 1874.

1851. There were 13 paper manufacturing companies in Lee, Mass., running 25 mills, and producing at the rate of about 25,000 pounds of paper per day, valued at $6,300, or two millions a year.

1851. Nov. 11. The lower paper mill at Union

Falls, in the town of Marcellus, N. Y., owned by George W. Ryan, was burnt, with a large quantity of stock; loss more than $8,000; insured $4,000.

1851. George West, of Tyringham, Mass., invented an improvement in the pulp-strainer, which consisted of a better separator of the impurities by a strainer, operated upon by a bellows.

1852. The quantity of paper manufactured in Great Britain and Ireland was 154,469,211 pounds, valued at two millions sterling, of which 7,328,886 pounds were exported.

1852. The number of paper mills at work in England was 304; in Scotland, 48; in Ireland, 28; total, 380. There were 1,616 beating engines at work, and 130 silent. Sharp's *Gazetteer* states the number of paper mills to have been 800, employing 30,000 workmen; but the *Jury Report* of the London Exhibition of Industry, gives the number of mills as being only 415, including England, Scotland, and Ireland; some of which were idle.

1852. J. Mansell, of London, patented a mode of ornamenting paper, which consisted of imparting to it a resemblance to plain damask weaving, by passing it between plates.

1852. Jean A. Farina, of Paris, obtained a pulp for the manufacture of paper from the plant called *spartum*, or waterbroom, using both the stalks and the roots. This material at first encountered great opposition both from proprietors and their workmen, but finally assumed vast importance as a raw material. The

stationer discovered that he could use 12lb. demy as 14lb. demy rag. It was known to the Romans.

1852. G. W. Turner, of London, improved the paper machine by the application of the endless wire-web in combination with and passing around the cylinder, and taking the pulp up from the vat, carrying it forward and submitting it to the action of the dandy roller and pneumatic trough, taking the place of the fixed wire-web and endless felt, in the cylinder machine, and the wire-web upon which the pulp flows in the Fourdrinier machine. Also for a mode of passing the paper through a trough of size, between two endless felts, obtaining a uniform and thorough saturation.

1852. Joseph Kingsland, of Saugerties, and Norman White, of New York, patented an inprovement in the mode of drying sized paper.

1852. The United States exported to foreign countries paper and stationery to the amount of $119,535, during the year ending June 30.

1852. The export of paper from Germany was 40,000 quintals, a country which twenty years earlier imported largely.

1852. The prices of rags in England were:

1st	quality	26*s.*	per cwt.
2d	"	16*s.*	"
3d	"	11*s.* 6*d.*	"
4th	"	7*s.*	"

1852. The export of rags from England had seldom exceeded 500 tons a year, but this year no less

than 2,462 tons, mostly British and Irish, were exported.

1852. The United States imported rags from thirty-two countries, to the amount of 18,288,458 pounds, at 3.46 cents a pound, amounting to $626,729. The consumption of paper was equal to that of England and France together. Of the supply of foreign rags 12,220,570 pounds came from Italy.

1852. Spartum or waterbroom, since known as Exparto, a fibrous grass which grows on the sandy shores of Spain, was introduced as paper stock, and has ever since continued to be the most valuable fibre yet discovered as a substitute for that of linen. See page 111, waterbroom.

1852. Feb. 14. A paper mill at Windsor Locks, belonging to William English, was burned with the stock and machinery in the mill, valued at $2,000.

1852. April 18. The paper mill of John and George Maynard, at Hardwick, Mass., was burnt. Loss $7,200.

1852. June 5. The Hollingsworth paper mill, at Groton, Mass., was destroyed by fire.

1852. June 5. Cauffman's paper mill, near Mariottstown, Md., was destroyed by fire. Loss $20,000, partly insured.

1852. The paper manufacturers of France published a protest against the proposed duty on paper, showing that it would not produce more than 3,000,000 of francs per annum.

1852. July 10. The paper mill of Platner & Smith,

at East Lee, Mass., was burnt; loss about $8,000, insured.

1852. July 30. Smill & Bell's mill at Old Hadley, Mass., was burnt. Loss $20,000; insured $6,000.

1852. Nov. 17. Todd & Brother's paper mill at Cooperstown, was burnt. Loss about $30,000; insured, $6,000.

1852. Coupier & Mellier, at Maidstone, Eng., patented a process, by which a pulp suitable for the manufacture of paper was to be prepared from wood. It consisted in allowing boiling soda or potash lye to act upon the wood cut into small pieces.

1852. There were exported from Cape Haytien during this year, 1,436 pounds of rags.

1853. The paper mill on Chester creek, Pennsylvania, which was claimed to have been established in 1713 (see 1729), and at which Franklin procured his paper, was announced as still in operation, having adopted none of the improvements of modern times, but continued to manufacture paper in the same mode as was pursued a hundred and forty years before.

1853. Jan. 10. Carter's paper mill, near Elkton, Md., was burnt.

1853. A sheet of paper was manufactured at Stirling, England, 3,000 yards in length, and 54 inches wide, weighing 400 pounds. It was made and finished, it is stated, within three hours, at a cost of a little more than £10.

1853. D. & J. Ames, extensive manufacturers at Springfield, Mass., failed for a large sum. See p. 68.

1853. Charles Knight, the London publisher, stated that in twenty years he had paid to government, in duty on paper, £50,000.

1853. Sept. 4. The mill of Jessup & Laflin at Westfield, Mass., was burnt. Loss $2800; insured $15,000.

1853. The value of rags imported into the United States from abroad for the year ending June 30, was $982,837, the quantity being 22,766,000 pounds at 4.31 cents. Of this quantity 2,666,000 pounds were obtained in England. Italy was the greatest source of supply, the quantity furnished being 14,171,292 pounds. Rags were imported from twenty-six different countries.

1853. The value of paper and articles manufactured of it, imported into the United States for the year ending June 30, was $602,659, exclusive of books.

1853. The export of paper and stationery from this country was $122,212.

1853. The import of rags into Great Britain during this and the two preceding years averaged yearly 9,332 tons.

1853. The quantity of paper manufactured annually in Great Britain during the five years ending with this year, was 151,234,179 pounds; which was an increase of 114 per cent in twenty years, while the whole population in that period had increased not more than 16 per cent. The estimated value of the annual product was £4,000,000.

1853. The quantity of paper manufactured in Great

Britain *and Ireland* was 177,633,010 pounds, of which 13,296,874 pounds were exported. The import of paper during the year was not far from 200,000 pounds; the consumption therefore was about 5.40 pounds *per capita* of the population.

1853. It was estimated that in France about 70,000 tons of paper were produced yearly; in England 66,000 tons; and that the production in this country was nearly equal to both France and England.

1853. France, with a population of 36,000,000 turned into paper annually 105,000 tons of rags, of which 6,000 tons were imported. Great Britain, with 28,000,000 population, required yearly 90,000 tons of rags, of which 15,000 were imported. The annual value of paper manufactured in Great Britain was estimated at $17,760,000.

1853. Watt and Burgess patented in England a mode of producing paper from wood. The wood was first reduced to shavings or fine cuttings. They took out a patent for the same in the United States in the following year.

1853. Brown & McIntosh, of Aberdeen, invented hollow moulds, composed of perforated metal, wire, or other suitable material, covered with felt, within which, after their immersion in pulp, a partial vacuum is created, so as to cause the pulp to adhere or be deposited on the felt surface in a layer of uniform thickness.

1853. B. A. Lavender and Henry Lowe, of Baltimore, Md., produced samples of paper from southern

canes, and from white pine shavings. They were sanguine that with proper apparatus, paper could be made of reeds, or wood, as the main staple, by their process, worth from 12½ to 16 cents a pound, at a cost not exceeding 6¼ cents a pound.

1853. J. P. Comly, of Dayton, Ohio, patented an improvement for separating paper by single sheets, which was finally successful, he claims.

1853. Messrs. Coupin & Mellier of France, produced some specimens of straw paper at the Crystal palace exhibition, manufactured at their mill by a process of their own invention, which was claimed to equal rag paper.

1853. Nov. 26, John Satterly's mill at Little Falls was burnt. Loss about $10,000; insured for $6,000.

1853. Nov. 20. The mill of John Wrinkle & Co. at Colebrook, Conn., was burnt. Loss about $8,000; insured for $5,000.

1853. A German patented in England a machine for manufacturing paper from wood. It planed and cut the wood into small particles and shavings preparatory to being acted upon by the engine. The inventor stated that paper was manufactured in the cheapest manner from fir, pine and willow trees.

1853. G. Stiff obtained a patent in England for forming paper by using lime water in place of the ordinary alkaline solution, in making paper of straw, grass, and other materials.

1853. The importation of paper into France did not exceed 337,104 pounds; the exports were

17,053,667 pounds. This gave 16,716,553 excess of exports. Deduct this amount from 156,800,000 pounds, the quantity manufactured, and we have left for consumption, 140,083,447 pounds, or 3.89 pounds *per capita* of the population.

1853. The value of paper imported into the city of New York was computed to amount to $340,824. By another account it was stated to consist of 3,418 packages, valued at $860,628.

1854. Samuel Nolan and Prof. Antisel announced the invention of a new paper making machine, for the purpose of working a new material into paper, which should greatly reduce the high price to which paper had arisen.

1854. A practical chemist exhibited in New York specimens of paper made entirely of straw, and others of grass, of a superior quality, which he asserted that he could produce for about half the cost of rag paper. He claimed the knowledge of a process for depriving straw of its silex, and other properties detrimental to the strength, opacity and pliability requisite in paper for general use.

1854. The consumption of rags in the manufacture of paper in Great Britain, by 380 mills, was about 201 million pounds, an increase of about one-half in twenty years. The quantity of paper produced therefrom was stated at 177,890,000 lbs. of which 161,700,000 lbs. were consumed, and 16,112,000 lbs. exported. In France the consumption of 235,200,000 lbs. of rags was supposed to produce 156,300,000 lbs. of

paper. The consumption of rags in the United States was assumed to be 405,000,000 lbs., and the weight of paper made, 270,000,000 lbs.

1854. It was stated on the authority of the *Demarara Royal Gazette*, that paper of a good quality had been successfully manufactured in that region from the plantain.

1854. Mons. Vivien, of Paris, attempted to convert leaves into a paper suitable for wrapping. The leaves were collected at a suitable season, and cut into small pieces and pressed into a kind of cake, which was afterwards steeped in lime water and reduced to pulp in the ordinary manner.

1854. The quantity of rags annually consumed in Great Britain and France combined was computed at 436,800,000 pounds, producing 291,200,000 pounds of paper, which was 4.55 pounds *per capita;* while the *per capita* of the United States was 10.80.

1854. The entire body of paper makers in Holland, more than 160 in number, petitioned the government against the free export of rags, which they alleged would destroy their business, the neighboring states having prohibited such exports or charged them with high duties.

1854. M. Kelin, of Belgium, invented a process for converting straw into paper, which differed from any other in use. The straw was steeped in water sixty hours, when the liquid was run off and the straw washed with a plentiful supply of water. It was then flattened by being passed between two rollers while

in a damp state, and afterwards cut into fibres of suitable length, and exposed to the sun's rays, until sufficiently bleached. It was now submitted to another steeping process, of three or four days, and subjected to the action of a solution of hyper-chloride of potash or soda until the straw acquired a sufficient degree of whiteness, when it was put into the engine.

1854. T. G. Taylor patented a mode of manufacturing paper from the stalks of the hop plant, in England.

1854. John Evans also obtained a patent in the same country for a new manufacture of paper from Brazilian grass; and John Jeyes for the manufacture of paper from twitch or couch grass.

1854. S. G. Levis, of Delaware county, Penn., patented an improvement in the mode of making thick paper.

1854. E. Maniere obtained a patent in England for fire-proof paper. The invention consisted in applying asbestos to the manufacture of paper. The asbestos was rendered very fine and pulpy, and was mixed with the pulp of rags.

1854. Messrs. John Richmond and Ephraim Cushman, of Amherst, Mass., patented an improvement for drying thick paper. "We claim drying thick paper, and at the same time preventing it from warping out of shape, to wit, by placing the sheets in a pulpy state upon heated tables or platforms, and allowing them to remain until they harden to such a degree as to begin to warp out of shape, and then causing open or lattice weights to be let down upon them, which rest upon

their edges or points at different parts of the sheets, and preserve them in flat positions until entirely dry." — *C. Gen.*, 339.

1854. E. L. Perkins, of Roxbury, Mass., obtained a patent for an improvement in polishing paper.

1854. A French paper maker experimented with wood in the manufacture of paper. Having taken off the bark, the wood was cut into shavings, and the shavings, which were very thin, were placed in water six or eight days; then dried; then reduced to the finest powder possible. This was mixed with rag pulp and subjected to the ordinary process. All white woods, such as poplar, lime, and willow, were deemed suitable.

1854. A French paper maker exhibited at the World's fair in New York, specimens of paper made of straw, which for whiteness, strength and beauty of finish appeared to be nearly equal to rag paper. It was manufactured by Coupier & Mellier, who patented the process in this country. Their success was superior to any of the 150 inventors who had patented as many different processes in England and France alone.

1854. The *Ledger*, a Philadelphia daily paper, having a very large circulation, perhaps 20,000 or 30,000 a day, was printed on paper made principally of straw, costing 9 cents a pound. It was a very inferior quality for the purpose. It was manufactured by Fienour & Nixon, at Manayunk, by what was denominated Mellier's process, by which, it was claimed, paper could be made of almost any vegetable fibrous substance.

1854. The quantity of paper manufactured in Great Britain, chargeable with excise duty, was 179,896,222 pounds, being an increase of more than a hundred million pounds, in twenty years. Of this quantity the exports were 16,112,020 pounds. The estimated value of the paper manufactured was £2,000,000 sterling. [See 1853.]

1854. There were 6 paper mills in North Carolina, consuming over 3,000,000 pounds of stock.

1854. There were 750 [450?] paper mills in the United States, in active operation, having 3,000 engines, and producing annually about 250 million pounds of paper, averaging about 10 cents a pound. This required 405 million pounds of rags, costing 4 cents a pound, for which our seamen had to scour every quarter of the globe. The cost of labor was estimated at 1¾ cents a pound; the cost of labor and stock united would be nearly twenty millions of dollars. The total cost of manufactuting $27,000,000 worth of paper was supposed to be $23,625,000. The demand, however, still exceeded the supply, so that the price was advanced 2½ cents a pound.

1854. The annual consumption of rags in Great Britain was computed to exceed 120,000 tons, three-fourths of which were imported, principally from Italy and Germany.

1854. The imports of paper and its manufactures into the United States during the year ending June 30, amounted to $757,829.

1854. The prices of rags in England were:

1st quality, 32*s*. to 34*s*. per cwt.
2d " 20*s*. "
3d " 15*s*. "
4th " 10*s*. "

1854. Tuscan rags used formerly to be sent wholly to the United States. The quantity shipped at this time was from 10,000 to 12,000 tons a year. Subsequently a portion of her exports went to England.

1854. The demand for paper in England affected the market in Jamaica so much that the two principal journals were compelled to reduce the size of their papers.

1854. The rise in the price of paper, 2½ cents a pound, obliged the publishers of cheap papers to increase their prices or reduce their sizes. Complaints of the price and scarcity of paper were universal. The *New York Tribune* was forced to go back to its former size. The *Journal of Commerce* said that it paid from forty to fifty thousand dollars a year for paper. The *New York Times* said that their bill for paper was sixty thousand dollars. The *Daily Evening Register* of Philadelphia was discontinued on account of the high price of paper. *The Sun*, the oldest of the penny papers, was also reduced in size. Others put up their prices.

1854. George W. Beardslee, of Albany, made experiments with basswood, which resulted in obtaining a beautiful paper; the woody fibre was reduced to a pulp of fine whiteness, and the paper was soft and strong, but it was supposed to contain a large per centage of rags.

1854. A paper manufacturer in Otsego county, N. Y., patented a mode of working the fibrous parts of swingle tow into paper, in such a way as to produce a firm and very white article; yet so specious did it appear, that the editor of the *Albany Argus* was led to suggest the possibility that the tree of knowledge might have been a basswood!

1854. By the reciprocity treaty with Great Britain, rags, the growth of the British North American colonies or of the United States, were to be admitted into each country, respectively, free of duty.

1854. R. & J. C. Martin secured a patent in England for obtaining a pulp from wood, by first saturating with water, planks and other pieces of wood, then subjecting their surfaces to a toothed cylinder, or other instrument having teeth resembling a saw or rasp; by which the wood was reduced to a suitable pulp.

1854. A patent was granted to Alexander Brown, in England, for the production of paper from the bracken, or fern plants, of Scotland. Every part of the plant possesses strong fibres, producing a powerfully cohering pulp, requiring little or no sizing.

1854. James Sinclair patented in England the discovery of the use of thistles in the manufacture of paper, which had been known and experimented upon nearly a century.

1854. C. Hill manufactured paper in England from the stem and roots of horseradish, the rush and flag, and the vegetable remains of manures, which were bleached and reduced to pulp by the usual modes.

1854. The exports of paper and stationery from the United States is said to have been $187,325, and of books and maps, $191,843.

1854. J. Lallemand, of Besançon, France, patented a mode of making paper from peat.

1854. The quantity of rags imported into the United States this year was 32,615,753 pounds, of which 24,240,999 pounds came from Italy. The total value of them was $1,010,443, at 3.09 cents a pound.

1854. Obadiah Marland, of Boston, Mass., obtained a patent for an improvement in paper making machines.

1854. Herr von Parmewitz, inventor of a process of making wool from pine trees, presented to the king of Prussia specimens of paper made of the same mater al. Paper was also made of the red pine at Giersdorf, which was said to be so white and good as to be fit for writing or drawing, and needed no sizing because of its resinous quality.

1854. Woodward and Bartlett, of Massachusetts, patented an improvement in the machines for cutting rags.

1855. A specimen of paper manufactured from the common cane, the bamboo of the Mississippi river, was exhibited at St. Louis, and highly approved of.

1855. Watt & Burgess, of London, made elaborate experiments for the conversion of woody fibre into pulp. The wood was first boiled in caustic soda ley, and washed free from alkalies; it was then subjected to the action of chlorine, or an oxygenated compound of chlorine, and again washed to remove the hydro-

chloric acid, when the wood was again treated with caustic soda ley, and became immediately reduced to pulp; which being well washed and bleached was ready to be manufactured into paper. Paper of this material, it was claimed, would cost only £24 a ton, but if made of rags would cost £40.

1855. Henry Fourdrinier, surviving partner of the great firm engaged in the paper manufacture, in England, died, aged 90. The Messrs. Fourdrinier exhausted a vast fortune in perfecting the paper machine which bears their name, and died in poverty.

1855. The export duty on rags was abolished in England.

1855. J. N. Nevin, of Scotland, succeeded in fabricating rope and paper from the common garden holyhock. It had the appearance and texture of such paper as was used for bags and parcels by grocers, and was very clean and firm.

1855. A French paper-hanger was engaged in producing a design requiring upwards of three thousand blocks, at a cost of $10,000, the design alone costing $6,000.

1855. March 6. Daniel Joseph Patrick Hennessy died at Brussells aged 74; proprietor of the extensive paper mills at La Huepe in Brabant. He introduced improvements which completely changed the mode of manufacturing paper in that country, for which he received at various industrial exhibitions the gold medals awarded on such occasions. He claimed descent from the Irish kings, and his im-

mediate ancestors were Jacobin emigrants.—*Jour. de l' Imprimerie Belgique*, part XII, feuilleton.

1855. The *London Economist* asserted that, so great was the consumption of paper by the reading and writing population of Great Britain, rags could not be procured in sufficient quantity to meet the demand.

1855. The paper mill belonging to Messrs. Parker, at Westville, New Haven, Conn., was destroyed by fire.

1855. The paper mill of B. B. Bradley, at Niagara Falls, was destroyed by fire.

1855. James N. Kellogg, foreman of Dupont's paper mill at Louisville, Ky., made experiments in manufacturing paper from undressed flax.

1855. The *Saratoga Whig* was printed on paper made principally of straw by Messrs. Buchanan & Kilmer at Rock city. These manufacturers employed a French process of bleaching, and were successful in making printing and writing paper of good quality from three-fourths straw.

1855. The consumption of paper by *The Times* of London, was nearly 9 tons a day; a quantity which, the sheets being laid open and piled upon each other, would rise to the height of fifty feet; so that the supply for eight days would exactly equal the height of St. Paul's Cathedral.

1855. The rise of one-halfpenny a pound in the price of paper in England affected the public journals so much, that the loss thereby sustained by *The Times* alone, was upwards of $10,000 per annum, inducing the proprietors of that journal to offer a reward of

£1,000 for the discovery of a new and readily available material for paper stock.

1855. An Englishman by the name of Watts patented a mode of producing paper from wood shavings and bran, which he expected would take the premium offered by the proprietors of *The Times* for the discovery of a new material for the production of paper.

1855. The extensive paper mill of Gaunt & Derrickson, at Trenton, N. J., was almost totally destroyed by fire. The loss was estimated at $150,000. The mill was in full operation when the fire broke out. It was insured for $52,000.

1855. A paper mill which had stood twenty years at Essex, Vt., was destroyed by fire, with its contents; loss $12,000.

1855. Hugh Burgess of Roger's Ford, on the Schuylkill, introduced a process of reducing poplar wood to paper pulp by boiling it in caustic soda under pressure. The process of A. C. Mellier for the preparation of straw, combined with the above, became the property of the American Wood Paper Company, and was successfully used in the treatment of poplar for paper stock; "the crossing fibres of poplar, held together by an albuminous mastic," were dissolved by the united processes of the above patentees.

1855. It is stated in the New York *Paper-Makers' Circular*, that the number of mills in operation in Austria at this time, was 535, giving employment to 12,000 workmen; and that there were 165 mills in

the various kingdoms and duchies constituting the Zollverein states of Germany. But as this is less than half the number in operation ten years earlier, there would seem to be some mistake, or the machines had greatly diminished the number of hand-mills.

1855. M. D. Whipple, of Charlestown, Mass., obtained a patent for preparing wood for paper-pulp.

1855. George W. Beardslee having made satisfactory experiments for the conversion of woody substances into paper, commenced the erection of a mill at Little Falls, N. Y., for the purpose of manufacturing paper of bass-wood and other ligneous substances, under the auspices of a joint stock company. The enterprise was unsuccessful.

1855. S. R. Andries, of Chamblee, Canada, exhibited paper made of *gnaphalie*, or life everlasting, which he claimed could be produced cheaper than any other substance for the purpose of being manufactured into paper.

1855. Horace W. Peaslee, of Malden Bridge, obtained a patent for a machine for washing paper stock.

1855. G. E. Simon obtained a patent in England for a mode of manufacturing paper from plants of the different species of the family *sparganium*.

1855. G. Martonoi patented in England a peculiar process for producing paper from seaweed.

1855. Egyptian rags did not make appearance in this country until the present year, when a cargo of 1215 bales arrived, and were purchased by J. Priestley & Co. at 4 and $3\frac{3}{8}$ cents a pound on six and eight

months' time. The bill amounted to $25,000. — *Paper Trade Reporter.*

1855. W. Barabee undertook the introducion of perfumes into the pulp of paper, which he thought of sufficient importance to secure by a patent, in England.

1855. The drawback on paper used in printing Bibles and Prayer Books in England, was £9,958; in Scotland, £2,088.

1855. The United States imported 40,013,516 pounds of rags, of which 23,948,612 came from Italy. The value of these rags was $1,235,151, or very nearly 3.06 cents a pound.

1855. Richard Herring published a work, in London, on ancient and modern paper and paper making, with 25 specimens of paper, and on engraving of the paper making machine.

1855. Henry Glynn, of Baltimore, Md., obtained a patent for an improvement in the manfacture of paper pulp.

1855. Improvements in machinery and mode of manufacture, and the application of steam, had reduced the number of mills in Great Britain and Ireland to 380, or nearly one-half, in twenty years; while the quantity of rags annually consumed had risen to 201,600,000 pounds, or over a hundred per cent.

1855. Louis Koch, of New York city, patented an improvement in manufacturing paper pulp.

1855. Charles H. Hall, of Portland, Maine, made experiments with barks of trees, and succeeded in producing wrapping paper advantageously. He

fitted up a mill at Waterville for the purpose of manufacturing on a large scale.

1855. Kayaderosseros paper mill, near Ballston Spa, N. Y., erected in 1854, was stopped. It was designed for the manufacture of hanging paper, and had four engines of 500 pounds capacity, one of Gavit's 72 inch machines, revolving iron bleach, and all the modern machinery for staining, printing, and decorating in the highest style of the art, costing about $85,000.

1855. The paper mill of C. & O. Clark, at Woodville, Jefferson county, N. Y., four engines, was burnt; loss $12,000. It was rebuilt the next year, and furnished with four large engines, and a 62 inch machine, and turned out one ton of print a day.

1856. The New York Mercantile Library received a unique work on paper manufactures, prepared by T. H. Saunders, of London, for the Paris exposition. It contains a history of this department of industry, followed by specimens of the different varieties of hand and machine made paper, and of papers destined to special uses, as bank notes, checks, photographs. It is estimated that the work could not have cost less than a thousand dollars.

1856. The consumption of paper in the United States was computed to equal that of England and France together. Thus in France, with 35 millions of inhabitants, only 70,000 tons of paper were produced in a year, of which one-seventh was for exportation. In Great Britain, with 28,000,000 of inhabitants, only 66,000 tons were produced. While in the United

States, young and but little advanced in manufactures, 200,000 tons were annually manufactured.

1856. Henry Lowe, of Baltimore county, Maryland, made an experiment with southern cane, and produced a creditable specimen of paper, which was used in printing the *Baltimore County Advocate*. His mill was employed exclusively in manufacturing wrapping paper.

1856. The sum of £9,094 was paid in England for drawback of duty on paper used in printing Bibles, Testaments and Prayer Books, and £1,200 in Scotland.

1856. The mills of the Chelsea manufacturing company at Norwich, Ct., were producing 7 tons of paper daily; and the Pacific mills at Windsor Locks were supposed to be unsurpassed in their capacity by any mills in the world.

1856. The extensive paper mills of Piersse & Brooks, at Windsor Locks, Conn., were burnt, involving a loss of $75,000, two-thirds of which was insured.

1856. Edward Grantless, a marble cutter, of Glasgow, obtained a patent for a mode of making paper of stone!

1856. It was claimed that an excellent pulp for paper was obtained by subjecting to a newly invented process, the Scotch fern plant, the stems, stalks, and even the roots of which possessed a strong fibre, which was found to be peculiarly adapted to the manufacture of a powerfully cohering paper pulp; that the plants might be used either green or dry, but the latter was preferable.

1856. Paper for wrapping purposes was made at a mill near Hagarstown, Md., from refuse leather scrapings about currier's shops.

1856. March 5. The mill of Leonard Whitney & Son, at Watertown, Mass., was burnt. Loss $12,000, half of which amount was insured.

1856. It was estimated that if all the paper consumed in one year by the newspapers in the city of New York was put upon wagons, containing two tons each, they would form a procession thirty miles in length, requiring 6,000 wagons.

1856. Lasare Ochs, of Belgium, patented a mode of obtaining paper from cuttings, waste, and scraps of tanned leather. The scraps were placed in sieves on the ends of arms or spokes on a wheel, and then made to revolve in a stream of water; which operation, if continued long enough, washed out the tannin from the leather. After this about twenty per cent of old hemp rope was mixed and the whole cut up and reduced to pulp, from which a coarse wrapping was the result. A fair quality of paper was also obtained by the usual process, it was claimed.

1856. Wm. Clark, of Dayton, O., patented improvements in making paper of the bark of the cotton stalk. Instead of using lime or other alkalies, he boiled coal tar with the material used, in a peculiar manner.

1856. Horace W. Peaslee, of Malden Bridge, N. Y., obtained a patent for a drying cylinder. He employed a spiral tubular heater, upon a nonconducting cylinder, in combination with an exterior metallic casing as set forth.

1856. The amount of paper imported into France during this and the two preceding years, was 23,000 tons, having a value of about $7,500,000. The amount exported was 114 tons, valued at $200,000.

1856. P. H. Wait, of Sandy Hill, N. Y., patented an improvement in felt guides.

1856. Francis Burke, of Montserrat, West Indies, invented a mode of preparing paper pulp from the fibres of endogenous plants, without having recourse to the process of separating the fibrous matter from the component parts of vegetable substances, which is described in Wells's *Annual of Scientific Discovery* for 1857, p. 89.

1856. Pierre J. Davis, of Paris, patented an improvement in bleaching paper, which is described in the same work as the above. Also, H. Hodgkins of Belfast, Ireland.

1856. M. Didot, of Paris, patented a new method of bleaching paper-pulp. He immersed the pulp in a solution of bleaching liquor, made by saturating chloride of lime in water, and using the clear liquor, and then passed carbonic acid gas through it.

1856. Cowley & Sullivan, of England, patented a mode of bleaching straw pulp. The liquor (chlorine) is $1\frac{1}{2}$ to 2° in Twaddle's hygrometer, in strength; but a lower strength will not bleach the pulp, and a stronger liquor will injure it, and not produce so good a color. While the straw is undergoing bleaching, it is carefully watched, and as soon as it assumes a reddish color, just merging on the white, a jet of steam

is cautiously let on and continued two hours, until the liquor has attained a blood heat, or 90°, which is kept up about two hours longer, when the straw will be completely bleached, and fit for the beating engine. Unless the steam is gradually introduced, the color will not be good.

1856. Vespasian O. Balcom, of Bedford, Massachusetts, obtained a patent for an improvement in grinding paper stock, which consisted of a revolving pulp-tub, in combination with a grooved grinding roller, revolved thereon at a greater or different speed than the tub.

1856. Joseph Kingsland, Jr., of Franklin, N. J., patented an improvement in the engine for grinding pulp — a process of reducing fibrous matter in water to pulp, by grinding it under hydraulic pressure, which creates a current that feeds the fibres into the grinder, and removes it therefrom as fast as it is sufficiently reduced, and renders the feeding independent of the grinding.

1856. The straw paper mill of John R. Hoes, at Stuyvesant Falls, Columbia county, New York, was destroyed by fire, with all the stock and machinery. The loss was $8,000, there being no insurance upon any part of it.

1856. The *Overland Mail*, published at Hong Kong, China, was printed on stout and heavy paper, of fine texture, made from the shavings of bamboo.

1856. There were twenty paper mills with seventy-five engines in the town of Lee, Mass. These con-

sumed 1,100,000 pounds of rags annually, and gave employment to 1,000 people; the quantity of paper manufactured was 780,000 reams, worth $1,300,000. Much of this was a cheap writing paper.

1856. July 31. The paper mill of G. W. Ingalls, at Ballston Spa, was destroyed by fire. Loss $20,000; insured $12,000.

1856. Israel Kinsey, of Hohokus, N. J., patented an improvement in feeding pulp to machines.

1856. William Clark, of Dayton, Ohio, patented a mode of making paper from straw.

1856. An English manufacturer produced pasteboard from beet roots.

1856. Dr. Terry, of Detroit, experimented upon a species of moss obtained in the Lake Superior region, and obtained a beautiful white paper, without any peculiar process. The moss existed in great quantities, on Isle Royal and other localities, and could be procured at a very moderate cost.

1856. An unusual freshet occurred in the Kayaderosseras river, by which the paper mills situated upon it suffered to great extent by the loss of their dams or damage to the mills and machinery.

1856. The *Syracuse Standard* boasted that its issue was printed on paper made of rags imported directly from the land of the Pharaohs, on the banks of the Nile. These were said to have been stripped from the mummies.

1856. M. Maurice Diamont, of Bohemia, laid before the minister of finance a project relative to the

manufacture of paper from maize, or Turkish wheat, and experiments were made at the imperial manufactory, which resulted in the production of various kinds of writing and printing paper, but at considerable additional expense over rag made paper. Another attempt was made three years later, with better success; but the result was still unsatisfactory. A manufactory was then established at Temesvar to obviate the expense of transportation of the raw material; but the experiments were unsuccessful. (See 1862.)

1856. The quantity of exports reimported into Great Britain, was 50 tons.

1857. Messrs. Laflin Brothers disposed of their extensive paper mill at Herkimer, New York, for $70,000, to the Kent Paper company, an unsuccessful enterprise.

1857. It was announced that a new mode of preparing straw for white paper had been discovered, which was expected to become valuable.

1857. The paper mills of Russia, 181 in number, gave employment to 11,730 persons, and produced paper to the value of $3,250,000.

1857. Edward B. Bingham, of Brooklyn, N. Y., made an improvement in the cylinder machine, consisting in the employment of an endless apron, placed at each end of the cylinder, and close to it, and having a traversing motion to that of the cylinder; the apron laying the pulp like a cross-lap on a web of cotton batting, thereby rendering the paper made by such

machine much stronger, and of a more uniform texture.

1857. Louis Koch, of New York city, patented an improvement in the manufacture of paste-board.

1857. J. S. Blake, of Claremont, N. H., obtained a patent for an improvement in making paper, which was designed to embrace a superior method of trimming the edges of the paper cut from the pulp, the proper discharging of the strips cut from it, and the keeping of the felt apron properly distended, to prevent creasing the paper, and preventing considerable waste.

1857. J. A. Roth, of Philadelphia, patented the combined application of sulphuric acid upon woody fibres, with that of the chlorine bleaching agents.

1857. Patrick Clark, of Rahway, N. J., patented a mode of cleaning felts and cylinders with the water that has been separated from the pulp, thus avoiding the necessity of introducing for that purpose water from any other source, into the machine.

1857. C. F. Sturgis, of Carlowville, Ala., patented a process of manufacturing pulp from the bark of the root and stalk of the cotton plant.

1857. Mons. A. C. Mellier, of France, patented a mode of making pulp, by boiling in a solution of caustic soda in a temperature not less than 310° Fahr., after it had been soaked and cleaned, and before submitting it to the action of a solution of chloride of lime; and the use of a rotary vessel separate from that containing the steam heat.

1857. A paper mill at Nassau, Rensselaer county,

N. Y., was destroyed by fire. It belonged to A. P. Van Alstyne, and was uninsured. Loss estimated at $12,000.

1857. R. H. Collyer, of Camden, N. J., claimed the exclusive use and employment for making paper and paper manufactures, in any combination or proportion whatsoever of the residue prepared, so as to retain and preserve the albumino-mucilaginous substance, or in any other manner substantially the same as of beet-root, mangel-wurtzel, and other species of the genus beta, left after the sugar-making and distilling processes have extracted the saccharine matter.

1857. A company was formed with a capital of $400,000, for the manufacture of paper in Havana, Cuba. The enterprise was induced by the great consumption of paper in that island, and the high price it commanded.

1857. The paper of the notes of the Bank of England was distinguished by its color — a peculiar white, such as was neither sold in the shops nor used for any other purpose; by its thinness and transparency, qualities which prevented any of the printed part of the note from being washed out by turpentine, or removed by the knife, without making a hole in the place thus practiced on; by its characteristic feel, a peculiar crispness and toughness, by which those accustomed to handle it distinguished the true notes instantly; the wire or water-mark, which was produced on the paper when in the state of pulp, and which was easily distinguished from a mark stamped

on after the paper was completed; the deckle edges — the mold contained two notes placed lengthwise, which were separated by a knife at a future state of the process — this deckle producing the peculiar effect seen on the edges of uncut paper, and this edging being caused when the paper was in a state of pulp, precluded any successful imitation after the paper was made; also by the strength of the paper, which was made from new cotton and linen. In its waterleaf or unsized condition, a bank note would sustain 36 pounds; and when one grain of size had been diffused through it, it would lift 100 pounds.

1857. L. C. Stuart took out a patent in England for an improvement in drying sized paper, which consisted in passing it over and between a series of oblong cylinders, placed one above the other, and having their surfaces perforated with small holes, through which currents of graduated heated air were forced, which escaped and came in contact with both sides of the paper after leaving the sizing vat. The series of cylinders and the paper between them were exposed to the open air, so that the vapor should be free to escape, and not run with the paper to be again absorbed by them. The novelty of this improvement consisted solely in the perforated cylinders, as the employment of steam-heated rollers for the same purpose was common in this country.

1857. House & Co., paper manufacturers at Haddam Neck, C., made experiments with ivory shavings, and produced a quantity of paper upon which a part

of an edition of the *Connecticut Courant* was printed. The paper was said to be inferior to rag paper, but it was thought that it could be improved upon. The fact was, undoubtedly, that there was just enough ivory shavings used to spoil it, as has been the case with most of the samples produced of paper made of new substances in part.

1857. William N. Clark, of Chester, Conn., obtained a patent for the use of ivory as stock to make pulp for the manufacture of paper.

1857. A paper mill was burnt at Brattleborough, Vt., early in September, belonging to Esty.

1857. It appears by the returns of the paper tax in Great Britain, which is three cents a pound, that the whole amount of paper manufactured in that country during this year was 191, 000,000 pounds.

1857. June 19. The paper mill of James Howard & Co., at Manchester, near Pittsburgh, was burned with all its contents. It was the work of an incendiary. The loss was $25,000, and the insurance $10,000.

1857. Samples of writing paper, said to be of very excellent quality, were exhibited at an industrial exhibition in Vienna, manufactured from the leaves of Indian corn. (See 1828.)

1857. The importation of rags into the United States was 44,582,080 pounds, valued at $1,448,125. Of 35,591 bales from Italian ports, more than one-third were linen; the rest a mixture of cotton and linen. About 2,000 bales were from the cities of Hamburg and Bremen. The exportation of rags from France

and Rome was prohibited, and the few procured from Ancona were obtained by special permission upon the payment of large fees. The trade with Prussia and Germany was also prohibited by the high export duty. The exports from Alexandria and Smyrna were chiefly collected in Asia Minor by agents having license from the government, and could only be shipped after the domestic demand was supplied. In Trieste also, only the surplus was allowed to come away. The Trieste rags were collected all over Hungary. The largest shipping port was Leghorn. New York and Boston were the largest receiving ports.

1857. June. All the old books, papers, drafts, checks, letters which had been preserved in the United States Bank, in the long course of its immense business, were sold at Philadelphia to a paper maker, to be worked over into blank paper. The whole mass weighed over forty tons. Ten tons of it consisted of autograph letters of the first statesmen, politicans and financiers of this and other countries.

1857. W. E. Gaine, of England, invented and patented parchment paper. He discovered that when paper is exposed to a mixture of two parts of concentrated sulphuric acid and one part of water for no longer time than is required to draw it through the fluid, it is immediately converted into a strong, skin-like material. It must be instantly washed with water.[1]

[1] It has been found that common unsized paper, if immersed in a solution of sulphuric acid — three parts of water to one of acid — and

1857. James Brown patented in England a mode of treating paper and paper material with glycerine, for printing and other purposes.

1858. Feb. 24. The paper mill at North Bennington, Vt., was burnt, with all the stock and machinery, involving a loss of $30,000, of which only $6,000 was insured. It was owned by Houghton & Graves.

1858. Mr. Barry, manufacturer of a substitute for paper from animal substances, was prosecuted by the crown, in England, for not having taken out a paper maker's license, and for not submitting his works to the usual discipline of the excise. The defendant contended that the article in question, being manufactured from hides, was parchment, and not paper. It so much resembled parchment, that a good many acquainted with such fabrics could not discover the difference. The court decided that the article being in the nature of paper, was paper within the meaning

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suffered to remain there three minutes, becomes, when taken out and well washed in cold water, almost exactly like parchment. It shrinks somewhat, but it is increased fully eight fold in strength, while no change in its weight takes place. A number of scientific men in this city, professional and amateur, have been experimenting on it, and with the most astonishing results. It has been brought before the Academy of Natural Sciences and the Franklin Institute, and the accomplished gentlemen of those institutions confess that they are wholly unable to account for the change that is produced in the paper by this very simple process. The only thing known is that the change takes place, and that the commonest kind of paper acquires all the properties of parchment. There must be care taken in its preparation, and the paper, before drying, must be ironed, or calendered; but nothing else is necessary.—*Philadelphia Bulletin*

of the act, and the jury finding for the crown, the damages were put at £100.

1858. Thomas Bonsor Crompton, the English paper manufacturer, died, at the age of 66, leaving a very large fortune. Besides the Farnworth Paper Mills, he became the proprietor of the extensive manufactory at Worthington; supplied the principal newspapers and merchants of London with paper; invented the continuous drying apparatus now in general use; was also an extensive manufacturer of cotton, and for some time the proprietor of the *Morning Post*, and other newspapers. Indefatigable in business, he was at the same time an ardent sportsman, public-spirited, a conservative in politics, and noted for his hospitality.— *Appleton's Cyclopedia.*

1858. The oldest rag picker in Paris, died at the age of ninety-one. This old man, like most of his profession, was once rich, and his money being squandered, he fell down the ladder of society, rung by rung, until he reached the bottom. He was well educated, and his brethren of the rag tie, looked up to him with respect. The rag pickers reserved him a number of streets into which no one was allowed to venture on his picking excursions, and gave him a monthly allowance of pocket money for his gin and tobacco. His comrades buried him, and his funeral was largely attended by rag pickers.

1858. Stephen Rossman, of Stuyvesant, New York, invented a lifting-roll to prevent the breaking or tearing of the paper as it passes from the upper of the

second press-rollers to the dryer. This was attained by passing the web of paper between the lifting-roll and the upper press-roll. The slight cohesion of the web to the roll eases it off, and prevents it breaking, and if a slight break should occur in the web, it prevents the edge of the break from being carried under the doctor, and thereby increased. It was claimed that it effected a great increase in the quantity of paper produced in a given time, by saving nearly all the time that is expended when breakages of the web occur.— *Scientific American.*

1858. A patent was reissued to Ladd & Keen, assignees of Watt & Burgess, of England, for a mode of pulping or disintegrating shavings of wood and other similar vegetable matter for making paper.

1858. J. & R. McMurray, of New York, patented an invention, the object of which was to obtain a very rigid frame, that would retain its form, so as to ensure a perfect cylindrical wire-cloth surface — designed to be used in paper machines, but applicable to other purposes also.

1858. S. S. Mills, of Charleston, S. C., patented a machine for separating the fibre from pulp in hemp leaves. The invention consisted in the use of a shredding cylinder, heckling device, and scutching cylinder, in connection with reciprocating clamps, or holders, arranged so that the separation of the fibrous portion of the leaves of hemp from the soft, pulpy portion, is readily effected, and in a perfect manner.

1858. Charles Marzoni, assignor of J. Gandolfi,

patented the use of "the peculiar stone called adamantine," as a means of tearing the woody fibre into a state suitable for pulp.

1858. March 3. The paper mill of S. A. Parks & Co., at Ballston, was destroyed by fire at night.

1858. March 18. The paper mill of the Westville Manufacturing Company in North Amherst, Mass., was destroyed by fire. The building and machinery were insured for $4,000.

1858. The Housatonic paper mill of Platner & Smith, at Lee, Mass., was burnt. Loss estimated at $150,000, on which there was an insurance of nearly $30,000. It was one of the most costly mills in New England, the proprietors having procured the most perfect machinery that could be obtained.

1858. May 4. The paper mill of Messrs. Hanna & Sons, at Steubenville, Ohio, was burned. Loss estimated at $50,000; insured for $9,000.

1858. May 24. The paper mill of Croswell & Son, near the village of New Baltimore, Greene county, N. Y., was destroyed by fire, together with $1,000 worth of paper. The loss was about $15,000.

1858. At a meeting in Leipsic of the Booksellers and Publishers Union, it was unanimously determined to erect at their own cost, a paper mill, in consequence of the extortionate prices demanded by manufacturers, and the combination among them to keep it at the great price to which they had raised it.

1858. Sept. 14. A paper mill at Chatham Four Corners with the dwelling house and outhouses be-

longing to it were burnt, and an old man named Levy Garvey was with difficulty rescued from the flames. The mill belonged to Mr. Isaacson.

1858. Henry Lowe stated that previous to his invention it had been found impossible, practically, to manufacture paper from reeds; he now obtained a patent for a mode of producing reed fibre from *arundinaria macro-sperma* of Michaux, and its employment in the manufacture of paper.

1858. Henry Lowe, of Baltimore, patented a mode of making paper from reeds, by first disintegrating the reeds by boiling in a solution of caustic soda, accompanied by agitation, and then reducing them directly to pulp without reducing to half stuff by the machine technically called the old rag engine.

1858. Sept. 20. David Carson, an eminent paper maker, died at Pittsfield, Mass., aged 75. He established himself in business at Dalton in 1811, and during a period of thirty-one years obtained a wide-spread reputation as a manufacturer. He had retired with a competency in 1842.

1858. Aug. 12. The paper-mill on Bath island, near Niagara Falls, was entirely destroyed by fire. Loss about $100,000. The *New York Tribune* was supplied by this mill.

1858 An effort was made to introduce the residue

of beet root from the sugar manufactories of Europe for paper stock, Dr. Collyer having patented a mode of producing paper from that material.

1858. Martin Nixon, of Philadelphia, patented an improvement in the preparation of straw for pulp, which consisted in applying the steam whereby the solution was automatically and continuously delivered on top of the straw; and the process of boiling the whole straw by the combined action of an upward current of steam, and a downward current of alkaline solution, permeating the mass, and acting upon it in conjunction.

1858. Nov. 24. The storehouse connected with the extensive paper mill of Tileston & Hollingsworth, Milton, Mass., was destroyed by fire. Loss $20,000; insured $10,000.

1858. A water-proof packing paper was brought into use in England, consisting of common paper covered with a very thin coat of gutta percha, dissolved in turpentine and put on the paper in a liquid form with rollers.

1858. D. Lichtenstadt obtained a patent in England for making pulp for paper and other fabrics from leather or any kind of animal fibrine, whether in large or small pieces, shavings or shreds, either tanned or untanned. The fibrine was first cleaned by being mixed for about two hours in a composition of water, caustic lime, and potash; then washed in cold water, and mixed with gypsum, or alumina, when it was ready for the pulping engine. When in the tanned

state, it was treated with caustic lime or limy matter mixed with sal ammoniac, ammonia, or ammoniacal compounds, to extract the tannin, and afterwards washed successively in an acid liquid and water to remove the caustic liquor, when it was pressed and converted into pulp in the usual way.

1858. Thomas Lindsay, of Westville, and William Geddes, of Seymour, Conn., invented a mode of varying the width of paper while the machine was in operation. The invention consisted in having the lip or basin which conducts the pulp from the endless wire-apron constructed in two parts, so that one part may slide over the other, and having the parts connected with the deckles, which, as well as the deckle-straps, were by a novel mechanism rendered susceptible of lateral adjustment.

1858. Isaac N. Crehore and Francis Stiles patented an improved lead plate, composed of sheet-metal knives, corrugated, or formed with a series of angles, or curved lines, through their entire length, for a rag engine; the lead plate in use being objectionable from its liability to breakage, and the difficulty of repairing it when once injured or broken at any point.

1858. Oct. 3. The extensive paper mill of Thomas Rice, Jr., at Newton Lower Falls, Mass., was totally destroyed by fire; loss nearly $15,000, insured.

1858. June 30. There was a decrease of six million pounds in the quantity of paper charged with duty in Great Britain in the half year ending with this date,

against 1857, the relative quantities being 99,483,635 pounds, and 93,462,130 pounds.

1859. Paper was so scarce in Madrid that several printing offices were forced to suspend business, and the journals pressed the government to allow foreign paper to be imported free, or at a greatly reduced duty.

1859. John Meyerhofer, of the city of New York, claimed an improvement in making paper impervious to water, mixing the alkaline solution of rosin with the pulp, and then adding what is known as English sulphuric acid; and after the sheets have been formed, drying them in contact with heated metallic surfaces.

1859. Morris L. Keen, of Rogers Ford, Pa., claimed an improvement in boilers for making pulp from wood; for boiling, under pressure, wood and ligneous materials for making paper pulp, constructed with an expansion chamber, stirrers and discharge valve.

1859. Martin Nixon, of Philadelphia, patented an improvement in boilers for treating paper stock: the boiler constructed to boil stock under a heavy pressure, by the combined action of an upward current of steam, and a downward current of hot alkaline solution, and admitting of the ready inversion of the boiler for the discharge of its contents when cooled.

1859. Palser & Howland, of Fort Edward, claimed an improvement by boiling straw or other stock for about four hours under a pressure of from 110 to 130 pounds, in a solution of caustic alkali, of a strength indicating from $3\frac{1}{2}^{\circ}$ to $3\frac{3}{4}^{\circ}$ R.

1859. Palser & Howland patented improvements in apparatus for the manufacture of pulp.

1859. The quantity of paper charged with duties of excise in the British kingdom, was 217,827,197 pounds, the exports were 20,142,350 pounds.

1859. Crocker & Marshall, of Lawrence, Massachusetts, patented a combination of internally-heated drying cylinders, with a steam-box for the purpose of continuously first thoroughly drying paper, and then superficially moistening it, by the direct application of steam prior to the operation of calendering; second, the combination of steam-boxes so arranged as to moisten paper superficially by the steam therein contained, with rolls which calender by pressure.

1860. F. De Compoloro, of France, obtained a patent for an improvement in the manufacture of pulp, claiming the employment of the cobs of Indian corn, either alone or with the husks.

1860. The number of mills in the United States had increased to 555, according to the census, employing a capital of $14,000,000, and having a total annual product of $21,000,000 — giving employment to 11,000 persons.— *Paper Trade Journal.* It also appeared by the census that the United States produced annually more paper than either Great Britain or France, and the annual consumption was computed to exceed that of both those countries together.

1860. Jordan & Keney (in connection with Grant, Warren & Co.), claimed a reissue for an improvement in machines for grinding and sizing paper-pulp — constructed of a simple conical grinder and outer shell, and with pipes for the introduction of the rags and

size, and the eduction of both, arranged with reference to the axis and ends of the grinder, so as to enable it to reduce the rags to pulp and mix the sizing therewith.

1860. The patent of Messrs. Kendall expired, which had been taken out in 1846, for bleaching paper pulp.

1860. Xavier Karcheski, of New York city, patented an improvement in the manufacture of vegetable parchment; claiming the application to certain parts of the paper, of starch or some other gelatinous substance, either plain or colored, for the purpose of producing a vegetable parchment, equal, or nearly so, in strength, to the animal parchment, and of a uniform transparency, with indellible water-marks, in such a manner that it could be used with particular advantage for bank bills and other paper of the same character.

1860. The paper manufactured in Massachusetts amounted to nearly six millions of dollars, which was over 58 per cent of the product of the whole Union ten years earlier.

1860. The Messrs. Smart, of Troy, N. Y., claimed an improvement in the manufacture of straw paper, which consisted in treating the fibre for making white paper by the successive operations of boiling, washing, and separating, or beating, and then applying the chemicals used for bleaching to the pulp.

1860. Thomas G. Chase claimed to have made further improvements in rendering paper incorrodible, by the interposition of a mixed powder of calcined feldspar, sulphate of lime, with the metallic oxide of magnesium, calcium, and iron, between the block of

caustic alkali coated with paraffine and rosin and the paraffine wrapper. He also claimed the composition of paraffine and rosin for the purposes described.

1860. Howland & Palser, of Fort Edward, N. Y., patented an improvement in the preparation of straw for paper pulp. Their *staple fibre*, as they termed it, was made from common rye or wheat straw, or other stalks. In preparing it, the substance was first cut into short lengths by machinery, and winnowed to remove impurities, then crushed and abraded by being passed between iron rollers, after which it went through a process of steaming, boiling, etc.

1860. Messrs. Howland & Palser claimed a reissue for an improvement in the manufacture of paper pulp, in the destruction or carbonization of the gummy, resinous, and other matters from which the fibre is to be set free, without injury to the fibre itself.

1860. Edward L. Perkins claimed a reissue for an improvement in machines for drying paper and other fabrics, consisting of the combination of a drying chamber with inlet and outlet passages for insuring a circulation through it, an apparatus for heating the same, and suitable carrying-rolls for suspending the fabric vertically in the drying-chamber, and for carrying it into and through the same.

1860. This year was unusually disastrous to paper mills, by fire and explosions. The paper mill of Samuel Hanna, in West Fitchburg, Mass., was partially destroyed by fire; loss about $2,000. The paper mill of Wm. Clark & Co., at Northampton, Mass., was

destroyed by fire; loss upwards of $40,000; insured $41,000. The paper mill of Goss & Russel at Dover mills, Mass., was burnt. The Greenleaf & Taylor paper mill was burnt at Springfield, Mass.; loss $25,000, insured $18,000. A paper mill at Ashland, owned by —— Morse, was destroyed by fire; there was an insurance of $8,000 on the building and stock. The paper mill at Saccarappa, owned by Josiah F. Day, of Portland, was burnt: the building was about 100 feet long and four stories high: loss estimated at $25,000; insured for $19,700. A steam boiler in the paper mill of Platner & Smith, at Lee, Mass., was destroyed by explosion. A workman was dangerously injured; the damage to property was about $600.

1860. Ephraim and John R. Cushman obtained a patent for an improvement in the manufacture of leather-paper stock; which consisted in heating the stock while it was in the beating engine, and removing the impurities as they arose.

1860. The rapid increase in the consumption of paper, especially of all kinds of book and news paper, during the period of a quarter of a century, was without a parallel; yet it was almost wholly supplied by American manufacturers. The long established policy of the government, combining revenue with the encouragement of home industry, had drawn a very large capital into this branch of business, and the production of paper fully kept pace with the demand. Notwithstanding the fact that capital and labor were so much cheaper in Europe than here, prices of paper ruled so

low in this country, that under a revenue duty of twenty-four per cent — the rate for many years prior to this time — the quantity imported was never very large, and was pretty much confined to French writing papers. Competition reduced the profits below the average of other branches of manufacture; the market also became overstocked, and prices at this time were reduced beyond precedent, resulting in an actual loss, and many mills were compelled to close business.

1860. About sixty-five per cent of the whole amount of paper stock was derived from domestic rags of cotton fabric, and twelve per cent from cotton waste, and rope and bagging used in baling cotton.

1860. Ebenezer Clemo, of Toronto, Canada, patented a mode of using nitric acid, the aqua fortis of commerce, in the conversion of straw and grasses into pulp; and for a subsequent treatment with a solution of hydrate or carbonate of an alkali, for the purpose of reducing the stock to a fine fibrous pulp, without subjecting it to the beating or other mechanical operation.

1860. The census returns reported the consumption of five million dollars worth of paper, ink, &c., per annum, in the city of New York, producing over eleven million dollars worth of books, newspapers, &c., employing more capital than any other business.

1860. Another plant, suitable for the manufacture of paper, was declared of easy growth in Algeria — the *hibiscus esculentus*, resembling the flax plant, also admirably adapted for the manufacture of coarse linen,

being far stronger than cotton. Its culture was highly recommended in the African colonies, to replace the defieiency of rags, so severely felt.

1860. A new kind of paper for making cigarettes was discovered, and a manufactory established in Algiers for working this new invention. The paper in question was made from the refuse stalks and portions of the leaves which had been hitherto thrown away or burnt as useless. It was calculated that the value of the rags from which the paper for the cigarettes had been usually made, amounted annually to from 9,000,000 to 10,000,000 francs.

1860. It was reported that England at this time required upwards of 120,000 tons of rags yearly, a large proportion of which were derived from foreign sources.

1860. In all the countries of Western Europe, including Holland, Belgium, France, Spain and Portugal, the export of rags and other paper-making material was prohibited, and an artificial cheapness thus produced; so that rags which were 3*d.* per pound in England, cost but 1½*d.* in France.

1860. Joseph Storm, of Woonsocket, R. I., patented an improvement in paper-rag engines, or rag-pickers, of which an engraving is given in the *Scientific American* of March 17, 1860.

1860. A step towards the final cessation of paper duties in England was made by the house of commons, in the import duties of paper, as follows:

		OLD.	NEW.
Mill-Boards,	per cwt., - -	£1 3 4	£0 16 0
Pasteboard,	do -	1 3 4	0 15 0
Brown paper,	do - -	1 3 4	0 16 0
Paper hangings,	do -	1 8 0	0 14 0
Fancy papers,	do - -	1 3 4	0 16 0
Waste paper,	do -	1 3 4	0 16 0

The duty which was established in the reign of Queen Anne, the house of commons, by a majority of fifty-three, resolved to repeal.

1860. Stephen M. Allen, of Niagara Falls, N. Y., claimed a new mode of treating fibrous materials, such as flax, hemp, jute, manilla, grass, sugar-cane, &c., in subjecting them to the action of air charged with moisture of vapor.

1860. May. The machinery for the first paper mill in Minnesota, arrived at the Falls of St. Anthony, where it was proposed to erect a manufactory. The consumption of paper in St. Paul was estimated at over fifty tons a year.

1860. There was exhibited in England a sheet of tissue paper which measured four miles (21,000 feet) in length, and six feet and three inches in breadth, the weight of which was but 196 pounds. It was manufactured in 12 hours.

1860. The quantity of paper supplied to the stationery office in London during the year ending March 31, was 3,601,119 pounds. The comptroller calculated that there was a saving to government, by the repeal of the paper duty, of £12,000. The sales of

waste paper during the same period, amounted to £6,269, which was £1,000 more than any previous year.— *Bookseller*, May 26, 1860, p. 282.

1860. Although the trade in paper collars was yet in its infancy, there was manufactured in Boston alone, 600,000. (See 1870.)

1860. C. S. Buchanan, of Ballston Spa, patented an improvement in boilers for preparing paper stuff: 1. The combination with a rotary boiler, or vessel, of a cylindrical strainer arranged within the boiler. 2. In rotary boilers, provided with cylindrical and concentric strainers, he claimed the construction and arrangement of ribs in the form of gutters. 3. He claimed providing the hollow journals of boilers constructed to operate as described, by rotation with a tubular plug capable of being shifted on its axis, such plug having one or more openings at the inner end so arranged as to allow of their coinciding with the channels or ways on the boiler heads, for the discharge from the boiler of liquid or steam, or both.

1860. J. L. Jullion, of Aberdeen, Scotland, obtained a patent in this country for an inprovement in the preparation of paper. He used compounds, prepared by precipitation, from watery or other solution of earths and acids, to consolidate and harden paper. 2. The use of chloride or oxy-chloride of zinc with glutinous matter as a size for paper. 3. The use of any of the before-mentioned prepared inorganic bodies, mixed with the sizing agent, to facilitate the absorption of writing and printing ink.

1861. July 20. The paper mill of Hunter and Patton, at North Bennington, Vt., was wholly destroyed by fire. Loss $20,000; insured $18,000. The mill had been closed three weeks, and the fire was attributed to spontaneous combustion.

1861. James Piercy, of Bloomfield, N. J., patented an improvement in washers for pulp.

1861. J. E. Malloy, of New York city, patented an improvement in the preparation of fibre, claiming a process of separating fibre from fibre-yielding plants, consisting of the separate and successive steps of combining, rubbing and washing the plants in cold water; the whole forming one continuous operation performed while the fibre is fresh and the plant undesiccated.

1861. J. H. Patterson, of Schaghticoke, patented an improvement for drying pasteboards, designed to facilitate the curing or drying wet paper or pasteboard sheets, by placing them in frames.

1861. Feb. 13. At a meeting of paper manufacturers at Pittsfield, Mass., to consult upon the depressed condition of the trade, twenty-one of the thirty-six fine writing paper mills of the country, and three-fourths of the capital invested (some $4,000,000), were represented. It appeared that the production of fine paper had been doubled within the previous ten years. An association was formed for the purpose of securing the members from the recurrence of a similar glut in the market, and it was decided, that for three months from the first of March, the production should be reduced one-third.

1861. It was estimated that 60,000 tons of kaoline were used in the manufacture of paper in Europe.

1861. Barne and Blandel, of Nantes, France, in the progress of experiments with wood fibre, patented a process based upon the action of nitric acid, which was made to act upon the moistened wood with application of heat, the resulting destruction of incrusting matters rendering the fibre soft and pliant.

1861. Joseph Jordan, Jr., of East Hartford, Conn., obtained a patent for an improvement in mills for grinding pulps by a peculiar arrangement of the knives.

1861. Experiments having been made with success at Baltimore, for converting the cane of the southern swamps into paper stock, mills were erected at Wilmington, N. C., for preparing the fibre upon a large scale for supplying paper mills.

1861. Gelston Sanford, of New York city, patented an improvement in mills for grinding pulp. He constructed the side of conical-shaped staves, with roughened surfaces, set alternately in reverse position, so that the space between them can be adjusted as set forth, in combination with the serrated rubbers.

1861. Henry Lowe, of Baltimore, Md., obtained a patent for an improvement in the process of recovering soda used in the manufacture of stock. He reclaimed the soda from the spent solution of caustic soda after its action upon reeds, straw, or other fibrous material, by charging the solution with carbonic acid gas, in a suitable vessel, so that the organic matter will be precipitated.

1861. Oct. 1. The excise and import duty upon paper in England was abolished. (See London *Publishers' Circular*, October, 1861.)

1861. Harlow Kilmer, one of the proprietors of the manilla paper manufacturing company, at Rock City, Saratoga county, slipped from the wheel and was caught in the cog gearing of the machinery, and his body cut entirely in two. He was 50 years of age.

1861. The state of Georgia having seceded from the United States, the *Macon Telegraph*, which had been printed upon paper manufactured in Georgia and South Carolina during the previous three years, was now printed on paper imported from Belgium.

1861. May 29. A paper mill at Lee, Mass., owned by Prentice C. Baird, was burnt with all its contents. There was an insurance of $14,000 on it.

1861. June 11. The straw paper mill of G. Chittenden & Son, at Stockport, Columbia county, N. Y., was destroyed by fire, together with 500 reams of paper and 300 tons of straw. Loss estimated at $15,000, of which $4,000 was insured.

1861. There were 15 paper mills in the seceded states, which produced 75,000 pounds of paper daily, while the consumption was over 150,000 pounds, and the entire suspension of newspapers was apprehended.

1861. T. H. Dodge, of Washington, D. C., patented an improvement in letter paper, which consisted in tinting the whole or a portion of the blank side, and combining with it the official embossed postage stamps.

1861. A. Randel, of New York city, patented an improvement in preparing stock, by a combination of differentially moving crushing rollers with the shreding cylinder and spiked concave.

1861. Straw paper, which was first made in Philadelphia in 1854, of a poor quality, was now so much improved as to be used by one of the daily papers. There were two or more manufacturers in New York state, and one in Cincinnati.

1861. Benjamin Lambert, of England, patented an improvement in the treatment of printed paper to remove ink and recover the pulp, to render it fit to be remade into paper.

1861. Moritz Diamant, an Austrian, invented a mode of preparing pulp from corn leaves, which was accounted a great discovery, and was stated to have been "an industrial fact confirmed by success," calculated considerably to influence the price of paper. This discovery was not a new one; in the eighteenth century the manufacture had been in operation in Italy with remarkable success; but, strange to say, the secret was kept by the inventor, and was lost at his death. Many attempts since made to revive the manufacture, recoiled before the difficulty of removing the silica and resinous matter contained in the leaves, and which obstructs the conversion of pulp into sheets. It was claimed that Diamant, a Jewish writing master, had rediscovered the process, and it was applied on a large scale at the imperial manufactory of Schlogelmühle, with such success that the paper obtained

left nothing to be desired in strength, homogeneity, polish, and whiteness; in short, that in several respects the paper was superior to that made from rags! (See *Scientific American*, vol. v, 1861, p. 203.)

1862. All the paper mills in Trenton, N. J., suspended operations because they could not get cash for the manufactured article, and had been heavy losers by the failure of consignees in the city of New York. The number of mills in Trenton was four.

1862. Jan. 16. The paper mill of Messrs. Bestow (?) & Fairchild, at Williamsville, was destroyed by fire, at a loss of $20,000, partially covered by insurance.— *Buffalo Express.*

1862. A. S. Lyman, of New York city, patented an improved process of separating the fibres of wood and other substances for the manufacture of pulp, by subjecting them in a close vessel to the combined simultaneous action of a whipping, beating, rubbing, grinding or picking apparatus, and of water at a high temperature and pressure.

1862. The paper makers held a meeting at the Astor House in the city of New York, in the autumn of this year, and resolved to increase the prices of printing paper. The result was that paper which had usually been sold for nine cents a pound was gradually increased to twenty-two, of the ordinary news quality, notwithstanding a vast quantity of old paper was procured from all quarters for stock.

1862. The catalogue of the Austrian department of the London International Exhibition, drawn up in

three languages, was printed partly on paper made from the stalks and husks alone of maize, or Turkish wheat, and partly from a mixture of maize with linen and cotton rags.

1862. Feb. 15. The paper mill of Charles Van Benthuysen at Cohoes was burnt. He stated his loss at $15,000. It had been constructed in the best manner, three stories high, and was just ready to commence operations.

1862. April 21. The paper mill of E. P. Russell, at Manlius, N. Y., was burnt.

1862. James Harper, of East Haven, Conn., patented an improvement in machinery for making paper. He combined, with the Fourdrinier wire-cloth apron, the couching belt, so arranged as to couch the paper from the wire-cloth by direct contact of the perforated cylinder, when those parts are so arranged that the cylinders support the wire-cloth and the couching-belt, respectively, directly opposite their points of contact with each other, and the combination with each other, when arranged, of the Fourdrinier wire-cloth, couching-belt, and beater.

1862. An association was formed among the manufacturers of fine writing paper in the early part of this year, who met at Springfield, Mass., and raised the price of writing paper from thirteen and fourteen cents a pound to seventeen cents for flat cap, and from fifteen to twenty-five cents for letter and note paper.

1862. William McFarlane, of Glasgow, called attention to the value of the *trash* of the sugar cane as

a material of paper, assuming that for every 2,200 tons of it, 2,000 tons of finished pulp might be obtained. The cost in London was estimated thus: fuel, £1,000; wages of a skillful workman one year, £200; capital invested (£300), at ten per cent, £30; loss by wear and tear, £30; freights from Jamaica to London, £7,000; and profits on the whole transaction, £10! the price of 2,000 tons of pulp, £14,000 in London, being £7 per ton, or less than one-half the price of rags.

1862. Henry Hayward, of Chicago, patented an improvement in safety paper; claiming the described means of designating varieties in the value or character of printed sheets of paper, in which threads of fibrous material are incorporated into and among the pulp, as described, to wit, the use of threads of different colors or characters arranged as specified.

1862. Oct. 6. The paper mill of D. & D. S. Mason & Co., at Bristol, N. H., was burnt. The building and machinery cost $18,000, and was insured.

1862. June 27. Louis Piette, editor of the *Journal de Fabricants des Papier*, died at Paris, aged 59. He published in 1831, a treatise on paper making, which went through several editions, and had prepared the second edition of a treatise on the coloring of paper-pulp, which was published the year after his death, with 229 specimens of colored paper. Although educated for the bar, he devoted his life with eminent success to the improvement in the manufacture of paper, and received medals in England, France, and Germany for

specimens which he produced at industrial exhibitions in those countries from 1842 to 1855.

1862. N. W. Taylor and J. W. Brightman, of Cleveland, Ohio, patented an improvement in machines for drying sized paper.

1862. It was stated by the *London Mechanics' Magazine* that excellent paper was now made in Europe from the leaves of Indian corn; there being a paper mill in operation in Switerzland, and another in Austria, which made paper exclusively from that material.

1862. M. Kolesoff reported the aggregate yearly production of Russia to be of the value of 5,680,000 rubles, the result of the labor of 12,000 workmen in 165 mills. This would give 72.07 workmen to each mill—a large force. And the product would be $317.50 to each workman, including all expenses of the mills. Yet all estimates of Russian manufactories give an equal proportion of workmen.

1862. By act of congress the import duty on rags for making paper was taken off.

1862. S. S. Crocker, of Lawrence, Mass., patented an improvement in machinery for cleaning pulp, by the combination of large and small receptacles, arranged to work together.

1862. H. D. Pochin, of England, prepared an anhydrous rosin-soap for sizing paper, as follows: take 150 parts by weight of rosin, 75 of soda ash, such as contains 46 per cent of alkali, and make the rosin-soap by beating and grinding. Then take 10

parts of such rosin-soap, and 18 of the ammoniate of alum, and form a solution of such a strength as may be required for paper of a common class. For fine paper, a rosin-soap was made with 165 parts of rosin, and 165 parts of soda ash.

1862. The Niagara Falls Paper Mill Company received orders from New York to run paper on reels in quantities equal to about 2,000 sheets, as by an improvement in feeding the cylinder press, the paper was fed, cut, and printed, at one operation, saving the labor of eight men.

1862. Nov. 21. Ordinary news paper, which sold early in the year at 8 cents net cash, was now 17 cents cash; all writing papers were at 40 cents a pound, and No. 1 printing, 30 cents.

1862. The war between the north and south having caused an enormous rise in the price of cotton, twine was now made of paper.

1862. A paper mill on the Fox river, Illinois, was using considerable quantities of sorghum in the manufacture of paper for wrapping and printing.

1863. Henry Pemberton, of East Tarentum, Pa., procured a patent for a mode of manufacturing pulp from the stalks of the sorgo, or Chinese sugar cane (a plant of the genus sorghum), as a substitute for linen and cotton rags in the manufacture of the better qualities of paper.

1863. A safety paper was invented in England, designed to prevent forgery or alteration of notes, or any paper demanding security. It consisted of a sin-

gle sheet formed of several layers of pulp, superposed, of different nature and colors, according to requirement. The middlle layer of the paper required only to be colored of a delible or destructible color; the chemical acid employed in obliterating the writing would also destroy this color, and it could not again be restored while the paper surface remained white.

1863. G. E. Rutledge, of Dayton, Ohio, improved the process of manufacture by a current in that portion of the fluid pulp in which the sieve-cylinder rotates, in the direction corresponding therewith, by which the periphery of the cylinder and the fluid pulp in which it rests are relatively at rest.

1863. The paper makers on the North Esk, in Scotland, near Edinburgh, were reported to manufacture more than 11 million pounds of paper, and to use 964 tons of chloride of lime for the bleaching. See 1807.

1863. John F. Schuyler, of Philadelphia, patented some new machinery for the purpose of planishing paper.

1863. Dr. Aloyse Chevalier Auer de Welsbach, of Austria, procured a patent in this country for a process of obtaining and separating the textile material contained in the husks, leaves, and stalks of Indian corn, by exposing the same, together with a solution of lime and soda, or equivalent substances, to the action of hot or boiling water, and preparing the material in a peculiar manner.

1863. John F. Jones, of Rochester, N. Y., in-

vented an improvement which consisted in a certain construction of what are termed the cylinder moulds, and the various kinds of boards produced from fibrous materials whereby provision is made for carrying away the water from their interiors through hollow journals, thereby dispensing with the use of packing inside of the vat by the substitution of stuffing boxes outside, thereby facilitating the repacking, and obviating much of the waste of stuff which is unavoidable with inside packing.

1863. Stephen M. Allen, of Woburn, Mass., obtained a patent for the manufacture of paper from wood, by cutting the wood in suitable lengths, crushing it in such a manner as to preserve the integrity of the fibre in its longitudinal direction, alternating steeping, and washing the same at increased temperatures, and finally boiling, grinding, and bleaching the same.

1863. A company was formed, composed of proprietors of the wood-pulp patent, who purchased the interest of C. S. Buchanan in his patents for making paper of straw.

1863. James R. McElfatrick, of Fort Wayne, Ind., obtained fibrous material from the bolls of the sycamore tree, for stock. It furnished a short staple of a buff color, which was thought to be as suitable as any other fibre, and could be procured in unlimited quantities in the Western states.

1863. A. H. Tait, of Jersey City, and W. H. Holbrook, of New York city, made an improvement in the manufacture of pulp, passing the straw between

grinding surfaces, and treating the stock, after it has passed through a weak alkaline and chlorine treatment with or without acid, to a second application of weak alkali and chlorine, with or without acid.

1863. P. A. Chadbourne, of Williamstown, Mass., patented a mode of manufacturing stock from wood, which consisted in rasping, filing, or scraping wood, while submerged in water, or saturated therewith, by the action or flow of a stream, whereby the fibre of the wood is strengthened or made sufficiently tough to avoid injury by the action of the rasps and other tools employed in the reducing of the wood, and a perfect separation of the individual or ultimate fibre from several united or connected fibres attained, and the rasps or other tools also kept, while in operation, in a perfectly clean state in proper working order.

1863. Jonathan Faw, of Lockland, Ohio, obtained a patent for an improvement in the rag engine.

1863. A new pulp-strainer was invented by Henry Watson, of Newcastle-on-Tyne, and Joseph Millbourn, of Dartford, England.

1863. The importation of esparto grass, or alfa fibre, into Great Britain during this year, was about 18,000 tons, and the use of it was estimated to have caused an increased consumption of 4,000 tons per annum of soda ash and bleaching powders. Nearly all the news paper used contained portions of it, and some of the cheaper grades consisted of only one-fourth rag material.

1863. John Cowper, of England, made an im-

provement in the mode of reducing rags and waste substances generally, by means of an endless feeder, upon which the material to be operated on is fed between a pair of fluted rollers, which deliver it to a rotating cylinder provided with teeth.

1863. Congress reduced the duty on printing paper to three per cent, at the request of the publishers, who asked for a total repeal of all duty. The high price of exchange nullified all benefit to them of the reduction of the custom.

1863. Stephen M. Allen, of Woburn, Mass., claimed the invention or a new article of manufacture, which he denominated tibrillia leather, or leather paper, consisting of leather scraps and vegetable fibre combined; also, the combined leather scraps steeped in warm water previous to being immersed in alkaline solution with the unrotted and reduced fibre of flax, hemp, or other like vegetable fibre.

1863. May 10. Tallman's paper mill at Ogdensburgh, N. Y., was burnt.

1863. A joint stock company with a capital of several hundred thousand dollars was formed, and preparations were made on a large scale for the manufacture of paper from bamboo, which grows in unlimited quantities in the island of Jamaica, and which, beyond serving to form partitions between the various ships' cargoes leaving that island, had never been exported, and was only used on the island for a few purposes. It now suddenly became an article of export, and the vast jungles of bamboo promised to become almost as

valuable as fields of waving grain. The bamboo, after being taken out of the ship, was tied in bundles about five feet long, which were soaked in a large tank for about 24 hours. The bundles were then placed in five large steam guns, each 24 feet in length and 15 inches in diameter. Here for half an hour the bamboo was subjected to a pressure of 180 pounds of steam, which reduced it to such a condition, that when, upon a given signal, the guns are discharged by the opening of one of the ends, the bamboo, in the shape of a quantity of fibrous material, looking as much like hemp as possible, was thrown out. This fibrous matter was then placed in a tank, and soaked in a solution of spent alkali. It was next washed, and went into what were termed the egg-boilers, so called from their likeness to that useful article of domestic consumption. Here the matter was subjected to another boiling and steam pressure, and from thence it was conveyed to the pulp-boilers, where it was boiled in a strong solution of alkali at 90 pounds pressure.

1863. J. F. Jones, of Rochester, N. Y., improved the machine for making paper and paper boards. He claimed: 1. The arrangement and combination of two or more cylinder-moulds, vats, felts, and press-rolls, whereby, in the same machine, any desired number of continuous webs of pulp of indefinite length may be either deposited one upon another for the continuous manufacture of boards, or may be kept separate from each other for the manufacture of several continuous distinct sheets of paper. 2. The combination with

such a system of cylinder-moulds, vats, felts, and press-rolls, of a series of guide-rolls, for separating the several webs of pulp as they are delivered from the press-rolls. 3. The combination of such system of cylinder-moulds as herein before specified, and a continuous series of drying cylinders and calendering rolls, in such manner that the manufacture of boards or of several webs of paper may be carried on by a continuous process. 4. The arrangement of several spouts, pipes, and valves, and self-acting feed-gate, in combination with each other and with the several vats. 5. The save-all, composed of a vat, a cylinder-mould, a coucher and a scraper combined and applied in connection with one or more paper making machines. 6. The combination of press-rolls, to obtain two pressures from three rolls. 7. The employment of calendering rolls on the top of drying cylinders, to equalize the water in the board, and make it of uniform dryness as it passes over the dryers, and partially effect the glazing and calendering process while the board is being dried.

1863. G. S. Sellers, of Hardin county, Illinois, made an improvement in preparing woody fibre for paper stock, by pressure in the line or nearly so of the fibre.

1863. J. B. Fuller, of Claremont, N. H., discovered a new mode of preparing vegetable fibre for paper. He claimed: 1. Curing vegetable fibre in a vessel by means of jets of steam. 2. An open grinder, receiving the fibrous material directly from the curing vessel, so

that the grinding operation is independent of that of the curing, but the vegetable fibre is ground while hot. 3. Separating the fibre from the overflow water by means of the sieve and brush. 4. Heating the interior of the grinder by the introduction of steam. 5. A column of water rising sufficiently above the grinder to produce the hydrostatic pressure necessary for curing the fibrous materials to pass through the grinder, as specified. 6. The double volute, a spiral channel for cooling the cured vegetable fibre and imparting the heat thereof to the uncured vegetable material traveling in the intervening volute channels in the opposite direction, was composed of three layers of different thicknesses, of which the central was colored with a delible or easily removable color, and the external layers charged with silicate of magnesia or other mineral or vegetable matter.

1863. M. L. Keen, of Roger's Ford, Pa., patented a boiler for making pulp, provided with a perforated diaphragm or well; also an arrangement of the discharge pipe and valve for the purpose of blowing out or discharging the contents of the boiler under pressure.

1863. The imports of paper at the port of New York were $125,141, yielding a revenue of $39,684; at Boston, $306,840, yielding a revenue of $90,688; at Baltimore and Philadelphia, none; giving a total revenue of $130,372. The secretary said it was impossible to state how much of this was for printing paper, but expressed the opinion that the diminution of the tariff would considerably increase the revenue.

An effort was made by publishers to get the duty removed, on account of the high price of paper.

1863. Feb. 16. The newspaper and book publishers of Boston appeared before the legislature of Massachusetts to urge the importance of memorializing congress for relief against the paper monopoly, as it was termed. It was shown that the cost of school books alone was five millions of dollars annually, and that this combination added twenty per cent thereto.

1863. Jan. 14. The entire edition of the *Boston Journal* was for the first time printed on paper made of basswood, *tilia americana*. The price of newspaper rose at one time to 32cts. a pound.

1863. Feb. 28. The paper mill of G. & W. U. Moore, on the Kater kil, was destroyed by fire. Loss $8,000; insured $4,000.

1863. Rags were exported from Madras this year to the amount of 2,022 cwts., being the first time that this article had appeared in the list of exports from that place.

1863. Experiments were made in England with potatoes for the production of half-stuff, for coarse and fine paper, by one Sellers.

1863. It was stated that paper was made at this time in large quantity from the swamp-flag, or cat-tail, and that the demand for it was greater than the supply; that it was used for card-board, and paper-hangings, for which it was well adapted.

1863. William Boaler, of Manchester, England, invented an improved dryer fabric for paper making;

which consisted in the substitution of a more suitable kind of cloth for the ordinary dryer felt in use for expelling and absorbing moisture.

1863. Joseph Prosper Olier, of Paris, France, took out a patent in this country for a safety paper, which was composed of three layers of different thicknesses, of which the central was colored with a delible or easily removable color, and the external layers charged with silicate of magnesia, or other mineral or vegetable matter.

1864. Philip Lichtenstadt, of New York city, patented a process for preparing fibre from the bamboo; separating and disintegrating the fibre contained in that article, by treating it with a solution of lime, nitrate of soda, and oxalic acid, and preparing the textile material for manufacturing purposes. He made experiments under disadvantages at a mill near New York.

1864. The official statistics of the French customs exhibit the following returns for the first five months of three years, on paper and pasteboard:

1862.	1863.	1864.
6,156,000 francs.	6,993,000 fr.	8,159,000 fr.

1864. Feb. 19. The paper manufacturers and paper companies of Great Britain and Ireland, 211 in number, representing 271 mills, petitioned parliament for an abatement of taxes and the exertion of the government for the removal of all restrictions abroad upon the export of all paper making materials — the export duties in some parts of Italy having been doubled

in amount; that in France and Belgium a duty of £5 per ton was levied on the export of rags; in Holland upwards of £4 per ton; and more than £9 per ton in Prussia and the Zollverein; while the export from England was free.

1864. Feb. 21. The steam paper mill of Chauncey Watson, at Middleburgh, N. Y., was burnt. Loss $8,000; insured for $4,000.

1864. Feb. 13. The boiler in Buchanan & Bullard's paper mill at Schuylerville, N. Y., exploded, and passed through eleven buildings, killing two persons, and destroying the building in which it had been used.

1864. J. A. Roth, of Philadelphia, patented a mode of preparing fibrous material from corn stalks, by solving and abstracting the components of the stalks by the application of one or more water baths in a boiling state, over 212° Fahr. 2. The use of the chemical agent, after the water bath or the boiling of the material under treatment has been completed. 3. The combination of treatment or process of the fibres of the stalks, and also the neutralizing of substances still adhering to the fibres after being washed by the application of sulphuric acid or its equivalent.

1864. George A. Corser, of Leicester, Mass., invented an angular bed plate for engines, for working stock; it is described as composed of two or more sets of angular plates, arranged in such a manner that the angles of the adjoining sets are inverted in relation to each other.

1864. The price of news paper reached 28 cents a

pound, and of fine book paper 45 cents a pound. A renewed research was made among the garrets and store rooms, induced by the payment of 8 cents a pound for waste paper. Thousands of tons of old books and newspapers, school and account books, correspondence and business papers of all sorts, were turned over to the mills, without lessening the price of white paper.

1864. During the last thirty years calico had been the favorite material for book covers; but it was so increased in price, owing to the war, that an enterprising firm conceived the idea of forming a paper substance having all the strength and flexibility of cloth, to take its place outside of books. This substance appears to receive gilt impressions with the distinctness of morocco, and as it can be washed with soap and water when dirty, it may be surmised that hereafter the phrase, "musty" literature, will fall into disuse. It is said that its cost will be something like one-half the price of the present embossed cloth.

1864. July 20. The extensive paper mill of —— Nixon at Manayunk, near Philadelphia, was destroyed by fire. Loss over $100,000.

1864. W. F. Ladd, of Tarrytown, and S. A. Walsh, of New York city, invented a boiler for pressing vegetable substances. In this improved apparatus the material to be reduced to pulp is to be treated either with or without alkali, and is at all times submerged in the liquor or solution employed in the boiling process. By an arrangement of a perforated

diaphragm in the boiler the material is kept at a certain point while the liquor rises above it, and the heat is applied either by a coil of steam, or by a traveling furnace arranged to run back and forth under the boiler; this furnace can be removed when it becomes necessary to stop the boiling; the contents can then be discharged through a grate into any suitable receiver.

1864. Henry F. Anthony, of New York city, invented a mode of albumenizing paper by combining or mixing the nitrate of ammonia directly with the albumenizing fluid.

1864. John F. Jones sold the Genesee paper mills at the Lower falls to the Rochester Paper Company, for $25,000. They commenced business with a capital of $100,000, and contemplated an extensive business, including the manufacture of straw and junk board.

1864. The exports from France of paper and pasteboard, for the first four months of this year, were 6,269,000 francs; against 5,624,000 francs for same period in 1863, and 4,925,000 francs in 1862.

1864. Richard Magee, of Philadelphia, invented a mode of coating writing paper, which he obtained a patent for as a new article of manufacture.

1864. It was announced that an active trade was carried on in Chester county, Pa., in poplar wood, designed for the manufacture of paper. The mills at Springfield were run by New York capitalists, and were extensive. The price given for the wood delivered on the line of Chester Valley Rail Road, was four dollars a cord.

1864. George Escor Sellers, Sellers Landing, Ill., discovered a method of preparing disintegrated vegetable fibre for paper stock, by the removal or change in the nature of the incrusting or adhering nonfibrous matter by fermentation and washings, previous to bleaching with chlorine. 2. The use of chlorine as a solvent for the nonfibrous portions of vegetable substances that have become discolored and hardened by heat in the process of disintegration, combined with boiling and hot-water washing to remove them from the fibre previously to bleaching. Mr. Sellers also patented a mode of forming, drying, and packing paper stock; claiming the above described mode of reducing pulp to a condition for transportation, by a system of alternate exhaustion and compression; also the use of the same mode for the combination of pulp or fibre and other matters of various qualities, for the purpose of producing boards or cards suitable for use in the arts.

1864. Jacob Storer, of Portsmouth, N. H., invented a mode of preparing vegetable fibre by the use of steam and vapor of water for conveying alkalies and other chemicals.

1864. The duty on rags exported from Russia by its western frontier was reduced one-half; that is, from $14\frac{2}{3}$ francs to $7\frac{1}{3}$ francs per kilometer.

1864. For the accommodation of the manufacturers of paper in the departments, docks were established in Paris, to facilitate trade in their products.

1864. W. B. Newbery, of Dorchester, Massachu-

setts, patented a mode of producing paper from *espartero*, or Spanish grass, either alone or in combination with manilla, jute, gunny, or other fibrous materials.

1854. The paper makers of Great Britain made complaint of the injury which their avocation sustained by the recent commercial treaty with France. Mr. Maguire addressed the house of commons on the 20th July, representing the grievances of the trade, and demanding an investigation. The complaint was of the tax of 12 per cent on rags exported from France. Notwithstanding the tax, Great Britain imported 4,215,630 kilograms during the year preceding, from France.

1864. A. K. Eaton, of New York city, patented a process of manufacturing paper-pulp from straw or other substances. 1. Subjecting it to a grinding process, commencing in the early stages of the treatment with hot alkalies, and continuing the grinding in connection with the alkaline treatment. 2. Purifying the alkali held in solution in the refuse liquor by passing it through a filter, rendering it suitable for use again, and completely reproducing it when necessary by making it into combustible cakes.

1864. The manufacturers of straw paper in several departments of France met at Avignon 22d May, and resolved to form an association, and to establish a minimum price for their fabrics. They decided to augment their prices from 1 to 2 francs per 100 kilograms (about two to four dollars per ton). The manufacturers of another portion of France met at

Avignon on the 16th June, and resolved to increase their prices 2 francs on thick and 4 francs on thin paper per 100 kil. A general meeting of the straw manufacturers of the empire was to be held at Paris on the 5th August; and on the 11th of the same month a convention of the paper makers of all denominations was called at Paris, to consult upon affairs of trade.

1864. The *Journal des Fabricants de Papier*, of France, calculated the annual consumption of paper in the world at from thirty-one to thirty-two millions of quintals; that the English employed annually 15 millions; France 5 millions; the German states, 1 million; Austria ½ million; and the rest of the world 10 millions of quintals.

1864. Lucien Bardoux, of Poitiers, France, took out a patent for a process of making pulp for paper and pasteboard, adapted to vegetable as well as animal substances, which had been patented in his own country in 1861.

1865. Jan. 5th. At a meeting of Ohio newspaper publishers in Columbus, a committee was appointed to memorialize congress against a prohibitory paper tariff.

1865. The *Paper Trade Journal* announced 73 paper mills in Sweden, employing 1613 workmen. This is so much in excess of other reports, as to indicate that some of them are erroneous.

1865. The Wood Pulp Works Company founded an establishment at Manayunk, Pa., having a capacity for producing 300 cwt. of wood pulp daily, by the chemical process of Watt and Burgess.

1865. The following scale of prices in the city of New York, for January, was published in *The Printer.*

Note paper, first class,	- - - -	55 @ 60	per lb.
" " good,	- - - - - -	50 @ 55	"
" " common,	- - - - -	45 @ 50	"
Letters and foolscaps, first class,		- 50 @ 55	"
" " second,		- 45 @ 50	"
" " common,		- 40 @ 45	"
Flat caps and folios, first class,		- 45 @ 48	"
" " second class,		- 40 @ 44	"
" " common,		- 35 @ 40	"
Common news, straw, etc.,		- - 20 @ 22	"
Good " rag,	- - - - -	22 @ 25	"
Fair white book,	- - - - - - -	25 @ 28	"
Extra book,	- - - - - - - -	28 @ 32	"
Sized and calendered book,		- - - 30 @ 33	"
Extra " " "	- - -	35 @ 40	"
Manilla wrapping,	- - - - - -	18 @ 20	"

1865. Feb. 2. The large paper mill of Elizur Smith, at Lee, Mass., was destroyed by fire.

1865. Congress was memorialized for a removal of the duty on paper, and in view of foreign paper being admitted free, news paper fell in price 8 cents a pound, contracts being made as low as 18 cents a pound.

1865. The operation of many paper mills was stopped by the long continued drouth, and the price of fine sized and calendered printing paper was advanced from 35 to 40 cents a pound.

1865. Sept. 26. The paper mill of Russell & Co., at Lawrence, Mass., was nearly destroyed by fire.

1865. There were seven paper mills in Ballston, N. Y., four of them devoted to printing paper, and three to wrapping, paper collars, and tissue paper. These mills averaged twenty-eight tons a day, estimated to be worth about $9,000.

1865. Dec. 13. The pasteboard mills at South Dedham, Mass., owned by J. Ellis & Co., were nearly consumed by fire. Loss estimated at $20,000; insured for $8,000. The mills were new, having replaced those burnt about eighteen months before.

1865. A company was organized at Glen's Falls, N. Y., for manfacturing straw paper of an improved quality.

1865. Dec. 20. The Black River paper mill, owned by A. J. Fullum, at Springfield, Vt., was burned: insurance small.

1865. The value of the paper manufactured in Massachusetts this year was computed at $9,008,521. There were 118 paper manufactories in the state, consuming 34,165 tons of stock. The capital employed was $3,785,300, and 3,554 workmen were employed.

1866. Feb. 4. The St. Charles paper mill, at St. Charles, Illinois, the largest establishment of the kind in the west, was destroyed by fire, entailing a loss of $110,000, on which there was an insurance of $20,000.

1866. June 16. Howland's extensive paper mill, situated in Saratoga county, on the banks of the Hudson river, between Mechanicsville and Stillwater, about one mile above the former place, was destroyed by fire. The loss was stated at $75,000, with no

insurance. There was $10,000 worth of paper in the mill at the time ready for shipment, but not a dollar's worth of it was saved.

1866. The editor of the *Bunker Hill Aurora* said, that a few Sundays before, he heard a clergyman, in illustrating a point in his discourse, state that during the late war, a New York merchant at Alexandria, in Egypt, having occasion to furnish a ship with a freight homeward, was led, partly through fear of pirates, to load her with mummies from the famous Egyptian catacombs. On arriving here, the strange cargo was sold to a paper manufacturer in Connecticut, who threw the whole mass, the linen cerement, the bitumen and the poor remains of humanity, into the hopper, and had them ground to powder. "And," added the speaker, "the words I am now reading to you, are written on some of this paper."

1866. March 3. The Agawam paper mill was burnt; loss $56,000.

1866. May 3. Howland, Palser & Co.'s paper mill was destroyed by fire, at Fort Edward. Loss $50,000; insured $18,000.

1866. The Carew Paper Company of South Hadley Falls, Mass., declared a yearly dividend of 100 per cent, reserving a fund sufficient to build an addition to their mill. Their dividend of the previous year was 120 per cent. Their capital was merely nominal.

1866. A girl employed at sorting rags in the Columbia mill, at Lee, Mass., found four $100 bills among the paper stock.

1866. It was announced that the paper mills of Great Britain manufactured 28,500 tons of paper a month.

1866. The great bamboo enterprise was thrown into the shade by another which was organized for the production of paper from poplar, and located at Manayunk, on the Schuylkill river. It had been discovered that poplar could be manufactured into paper in twenty-four hours, and with so much economy that it could be sold so as to afford a profit at ten cents a pound! Works were accordingly constructed of stone and brick in the most substantial manner, occupying a space 1,000 feet long by 350 wide, at a cost of over $500,000. United with the Flat Rock mills they were represented to embrace an area of about ten acres; and were thought to be the most extensive works of the kind in the world, and to be capable of producing from ten to fifteen tons of pulp a day. It was announced in the newspapers, which always exercise an unbounded liberality in figures in such cases, that the subscribed capital in this enterprise was upwards of ten millions of dollars. The grandest calculations were indulged in the abundant supply of poplar, with the aid of willow and other soft woods, nearly valueless for fuel; and were to result in as great a boon to civilization as the steam engine and the magnetic telegraph!

1866. Jan. 6. R. Paulin's paper mill at Manchester, Va., was destroyed by fire.

1866. The price of leather was so enhanced as to

stimulate efforts to produce paper of a consistence to form a substitute, in the manufacture of traveling trunks, and the success was so great that the deception was almost complete. (See 1830.)

1866. The prices of the various kinds of printing and writing papers had increased 200 per cent in five years, so that news paper which before the internecine war sold at 8 cents a pound was now 25; and fine book paper which had been furnished at 16 cents on six months time, was 40 cents cash. New York and Boston publishers resorted to European markets, at a saving of twenty-five per cent. The Harpers imported from Belgium, and Ticknor & Fields from London.

1866. The proprietor of *Lloyd's Newspaper* in London imported 270 tons of esparto grass from Algeria for the manufacture of paper for that journal. It was claimed that the cost of this kind of paper was one-half that of the linen fabric.

1866. McKerry's paper mill at Rockton, Illinois, was destroyed by fire. Loss $15,000.

1867. It was announced that L. Murray Crane, paper-maker in Saratoga county, N. Y., had invented a process of manufacturing paper which would prevent counterfeiting. His mode was to run minute threads of gutta percha through the sheet, that could not be imitated.

1867. The importations of paper into France in this year were 296,637 kilograms; of rags 5,136,569 kil. The exports 4,918,520 kil. of paper; 1,429,055 kil. of rags. (The kilogram being the 24th part of an ounce.)

1867. There were six mills in Saratoga county, N. Y., manufacturing paper from straw; using 9,000 tons of straw per annum, costing $100,000, and producing about 4,500 tons of paper.

1867. The end wall of a paper mill at Greenville, Conn., owned by Campbell, Hall & Co., of New York, was undermined by a freshet, and fell into the Shetucket river, entailing a loss of $20,000.

1867. Feb. 20. The boiler of the Wisconsin Paper Company's mill exploded in Milwaukie. Four persons were killed and three others injured. The damage to the mill was estimated at $20,000.

1867. It was announced that the following substitutes for rags in paper making were actually in use: abacca (manilla hemp), agave of Cuba, cultivated hemp, white hemp of Hayti, Indian hemp, cotton, acacia, fibres of aloes, Spanish broom, silk weed, hops, jute (Bengal hemp), down of date tree, flax, Chinese hemp, mallows, mulberry, Chinese nettle, New Zealand flax, esparto grass, linden, or basswood, yucca, bamboo of Jamaica and canes from the Carolinas.

1867. Dec. 16. A. L. Dunwell's paper mill at Newark, N. J., was burnt; loss $50,000.

1867. The demand for paper was so great in France this year, that numerous new mills were erected.

1867. The mills in the United States had been increased during the last four years nearly one-half. Instead of running night and day, as was the custom before 1861, by a combination among the trade, they

kept up the price of paper by running on short time; nevertheless towards the close of this year there was a considerable reduction in price. News paper was reduced from its maximum of 25 cents a pound to 16 cents.

1877. T. H. Saunders, a paper maker of Dartford, England, displayed at the Paris exhibition, samples of the shaded watermark of the most artistic forms, producing an effect almost incredible to those who were before familiar only with the old wire-marked paper.

1867. There were at this time in France 140 firms still engaged in the production of hand-made paper.

1867. May. To counteract the downward tendency of news paper, the Saratoga mills were run upon half time. This quality of paper now sold at about 16 cents, largely straw stock.

1867. May. The paper mills at Marietta, Georgia, destroyed by the northern army under Sheridan, were now rebuilt and running under favorable auspices.

1868. Jan. 4. The paper mill of J. G. Parker & Co., at Greenwich, Washington county, N. Y., was burnt. Loss $25,000; insured for $20,000.

1868. Complaint was made in England of the heavy twine and paper used by the manufacturers in wrapping, which amounted to 2½ per cent of the whole sum.

1868. Jan. 23. The mill of the Auburn Paper Company was destroyed by fire. It was situated near the city of Auburn, N. Y., and was insured for $16,500; loss $80,000.

1868. March 15. The paper mill at Waterville, Me., was burned. Loss $20,000; insured.

1868. Paper was now manufactured in various ways as substitutes for wood in roofing; for boxes and table tops; for pails, spittoons, wash bowls, buckets, and barrels; as resisting wear and tear, and the action of the elements, better than wood and iron! It was also employed for cuffs, collars, shirt bosoms, buttons, hats and bonnets; for tapestry, curtains and carpets, and belting for machinery. It was not now so much a matter of inquiry of what paper could be made, as of what could be made of it, so that it bade fair to enter into about every thing in use.

1868. The price of rags in Russia had increased 100 per cent.

1868. Jan. 23. Perrin's paper mill at Marshall, Michigan, was burnt. The loss was stated at $27,000, with an insurance of $9,000.

1868. Jan. 5. The paper mill at Shushan, belonging to James Partridge, was destroyed by fire. The mill was valued at $8,000, on which there was an insurance of $6,000.

1868. March 25. The paper mill of H. E. Rodgers, at Cheneyville, Ct., was destroyed by fire. Loss $50,000; insurance, $27,000.

1868. A French paper stated that the annual consumption of paper in England was 220 millions of pounds; that France consumed 195 millions; but that the United States consumed more than both England and France, the total consumption being 440 million pounds.

1868. There was not a single paper mill in Greece, the whole supply of paper being imported from Austria, Italy and France. About twelve thousand tons of rags, collected by four hundred persons, were annually sold to France and England.

1868. The ten paper mills at Holyoke, Mass., manufactured twenty-six tons of paper daily. About four-fifths of this was writing paper, the remainder collar, envelope, and tissue paper.

1868. The twenty-one paper mills in Lee, Mass., worked up fourteen million pounds of rags during this year; and the thirty-five mills in the county of Berkshire, which comprehends those of Lee, consumed twenty-eight million pounds.

1868. The importations of paper into France were 348,164 kilograms; of rags, 4,699,155 kils. The exports were 4,828, 944 kils. of paper, and 1,503,134 kils. of rags.

1868. March 31. Taylor & Co.'s paper mill at Westfield, Mass., was burnt. Loss $10,000.

1868. J. E. Hover, of Philadelphia, invented a kind of writing paper, charged with an earthy carbonate, by which common writing ink of the palest description, when applied to it, became intensely black. It was claimed that it took printing ink more readily, producing a black and smooth impression.

1868. A paper mill in Masschusetts was engaged in the manufacture of paper belting as a substitute for leather machine belts.

1868. June 4. The works of the American Fibre

Disintegrating Company, at Red Hook, Brooklyn, N. Y., were burnt. Loss $95,000. This company had expended large sums of money in experiments of blasting cane and bamboo from steam guns, to be used in the manufacture of paper, instead of submitting them to the ordinary grinding and saturating process in water.

1868. It was estimated that twenty-seven tons of paper a day were used in Paris by journals, reviews and pamphlets. The *Times* newspaper, London, consumed eleven tons of paper a day.

1868. Aug. 26. Hogan's paper mill at Rhinebeck was burnt. Loss stated at $30,000.

1868. Oct. 17. The Penfield paper mill at Rochester was burnt, having an insurance of $60,000.

1868. Thomas Manahan issued the *Paper Trade Reporter*, the first newspaper issued in the interests of paper makers in this country.

1868. The whole number of paper mills in the different countries composing the German empire was computed at 242 by the Leipzig *Correspondent*, and their annual production about 80,000 tons. See p. 230.

1868. The mannufacture of fine paper, for writing and printing, was commenced near Melbourne, Australia, on the bank of the Yatra. The colony had previously been supplied from Europe and the United States.

1868. Aug. 1. It was announced that A. C. Mellier, whose patent for making paper from straw

and wood had caused much litigation among various manufacturers throughout the country, had procured its extension for seventeen years.

1868. Nov. 17. The paper mill at Chatham Four Corners, owned by Smith, Tompkins & Co., was burned.

1869. Jan. 21. The paper mill of Mosher, Haight & Co., at Stillwater, N. Y., was destroyed by fire. Loss $40,000; insured $7,000.

1869. Feb. 27. A paper mill at Tyringham, Mass., leased and occupied by Watkins, Cassidy & Brother, was burnt. Loss $25,000; insured $12,000.

1869. March 4. The Pioneer paper mill at Ballston, N. Y., was burnt. Loss estimated at $160,000. It was one of the largest in the state.

1869. March 4. Carpenter's paper mill at Milton, Saratoga county, was burnt. Loss $50,000; insured for $20,000.

1869. Lucius Clarke, paper manufacturer at Northampton, Mass., died. The entire firm, father and two sons, had died within a year.

1869. March 20. The Cascade paper mills, near Clyde, N. Y., were burnt. Loss over $100,000; insurance $47,000. The company failed in July.

1869. March 22. The Waban mills at Needham, Mass., which manufactured sheathing paper, were destroyed by fire. Loss $25,000; insured $20,000.

1869. To the various paper productions of this paper age — paper collars, paper shirts, and even paper waistcoats, bonnets and hats — was now added paper

coffins. M. Szelelmey, their inventor, seemed to have a belief in the universal adaptability of paper to all the needs of civilized life. He undertook to coat ships with it, and make them impervious to shot; he employed it in the manufacture or construction of rocket cases, powder canisters, railway carriages, drain pipes and party walls. He claimed that it was at once lighter, stronger, harder and cheaper than any other material hitherto in use for these purposes, not excepting iron and steel and stone. His object in introducing it in the manufacture of coffins was to obtain what so many people rather absurdly consider a desideratum — a perfectly air-tight, water-proof and damp-defying shell, which nothing from without can penetrate, and nothing from within can escape. The Zopissa paper coffin, in which these conditions were said to be fulfilled, was a solid looking structure, very much resembling in build and thickness the ancient mummy cases preserved in the British Museum.

1869. May. The boiler of the paper mill of W. B. Mullin & Sons, at Mount Holly Springs, Pa., bursted. Damage, two men fatally injured, and loss $5,000.

1869. June 8. A paper mill was burned at Barrytown, N. Y.

1869. The reed cane of the Carolinas was subjected to the explosive force of steam, and then converted into a long fibre, which being cleansed by the application of cold water, presented a valuable article of commerce, which could be baled like cotton. It was sold in that form in the Eastern states at $20 per ton, to be made

up into wall paper, and to be mixed with manilla for wrapping paper; also for mixture with wool to make roofing-felt, and various other manufactures.

1869. The largest mill for the manufacture of writing paper was at Holyoke, Mass., which turned out five tons of paper daily. The engine room was 208×54 feet and contained 18 engines.

1869. June 8. James A. Weed's paper mill, at Port Dickinson, Broome county, N. Y., was burnt. Loss about $15,000; insured $13,000.

1869. In the town of Chatham, Columbia county, N. Y., 7,500 tons of rye straw were consumed in the manufacture of paper, yielding about 1,200,000 reams of various sizes. In the neighboring towns of Kinderhook and Stockport were numerous mills also engaged in the manufacture of straw paper for wrapping, and the price of straw had increased to $20 per ton.

1869. June 21. Beach & Co.'s steam paper mill at Sandy Hill, was burned. Loss $20,000; mostly insured.

1869. July 7. The paper mill of Noonan & McNab, at Humboldt, Wis., was burnt.

1869. Sept. 3. The paper mill of George Benton & Son, at Bennington, Vt., was burned. Loss $40,000; only partially insured.

1869. Sept. 14. J. H. Herrin's paper mill, at Warner, Mass., was burnt. Loss $14,000; insured for $10,000.

1869. Sept. 13. The paper mill of John Carroll, at Mill river, Berkshire county, Mass., was burnt. Loss $60,000, uninsured.

1869. The *Advertiser*, published at Portland, Maine, was printed on paper made of *Zisania aquatica*, or water rice. It grew in great quantity in the north-west, it was said; and a great reduction in the price of paper was predicted to result from the use of it.

1869. Oct. 22. Crane's paper mill at Dalton was burnt. Loss stated at $60,000.

1869. A Buffalo manufacturer claimed to be able to make better, tougher, and cheaper wrapping paper from wire grass, than from any other article in use. He procured it from Michigan at $30 a ton.

1869. Nov. 15. The steam boiler in the paper mill of Storms & Corsa, at Catskill exploded, and was thrown three hundred feet over the tops of the ice houses, and landed in the creek. The damage was estimated at $15,000.

1869. The rage for newspaper selling in London became so great that the girls took up the calling, and adopted a new device to attract attention, namely, the wearing of *paper aprons*, on which the names and contents of the papers they dealt in were conspicuously printed. The first female that had to go abroad for a living is said to have worn an apron of fig leaves, the latest resorted to the produce of straw!

1869. The English cultivated *paper grass*, a ton of which made a half ton of tough and durable paper, scarcely inferior to that made of rags, it was claimed.

1869. Experiments were made in California with *tule*, a product of the swamp land, which was said to give a good quality of white paper. There were at

this time two paper mills in California, but it was complained that they found it more profitable to make wrapping than printing paper.

1869. The importations of paper into France were 414,457 kilograms; of rags, 4,507,585 kils. The exports were 4,739,269 kils. of paper, and 2,549,511 kils. of rags. There was a tendency to a decrease of exports and an increase of imports compared with the two preceding years.

1869. Dr. Matthiessen, of England, presented an improvement which consisted of submitting disintegrated wood, as saw-dust and shavings, to a rotting process, by steeping in running or stagnant water, by which process certain constituents of the wood were decomposed and removed, and the subsequent treatment of the residual ligneous fibre for the production of pulp was rendered more economical, and the process of boiling and bleaching more easily effected.

1869. It was discovered that paper could be made transparent for the purpose of tracing by dampening it with benzine; and that the paper would resume its opacity on the evaporation of the benzine — thus enabling the use of thicker paper than when prepared by other processes.

1869. Machinery was invented for crushing bamboo, to fit it for shipment from the West India islands, to be used for paper stock. The difficulty of procuring the canes of the Southern states during the war of the rebellion, forced a search for similar material farther south, and it was largely exported from Jamaica to

New York, in bales and bundles. The bulk of the article, however, stood much in the way of shipment. The hold of a vessel was soon filled with it, and shippers did not care to take it as freight, any vessel so laden becoming top heavy. To prevent this, the vessel had first to be stowed with heavy articles, and the remaining space filled with bamboo. To obviate all difficulty, mill rollers were introduced to crush the bamboo, and by screw pressing, to pack it in bales, as was done with espartero and other bulky fibres.

1869. A French technical paper stated that any alterations or fabrications of writings in ordinary ink may be rendered impossible by passing the paper through a solution of one milligram of gallic acid in as much pure distilled water as would fill an ordinary soup plate. After the paper thus prepared has become throughly dry, it may be used as ordinary paper for writing, but any attempt to alter, falsify, or change anything written thereon will be left perfectly visible, and may be readily detected.

1869. Among the fibres of Southern India to which attention was called for use in paper and rope making, were the *Tchuma* (*Urtica nivea*) of Assam, and *ramee* (*Urtica tenacissima*) of Malay, identical with the *ramie* cultivated in the Southern states, brought originally from Java. The *rheea*, from China, a strong and lustrous fibre, but costly. The *jettee*, *moorva*, and pine-apple of India; also the *Pederia fœtida*, and *Bromelia penguin*, the latter furnishing the surprisingly beautiful Manilla handkerchief as well as the cele-

brated pigna cloth, and sometimes called silk grass.—*Annual of Scientific Discovery*, 1870, p. 98.

1870. Feb. 20. The Royal River paper mill at Yarmouth, Maine, occupied by Brown & Denison, was destroyed by fire, with all the machinery and stock. There was an insurance on the building and machinery.

1870. Among the sensations produced at this time by paper products, was that of petticoats, at 15 cents a piece.

1870. A French inventor claimed that he could so cleanse printed paper as to make it suitable for receiving a fresh impression. He stated that by immersing the printed sheet in a slight alkaline solution the ink would disappear, and leave the sheet of a pure and spotless white. This was thought to be bad for the trunk makers!

1870. March 27. The mills of the Hampden Paper Company at Holyoke, Mass., were destroyed by fire. Loss estimated at $250,000; insured $200,000.

1870. Jefferson Evarts, of Jefferson, patented a mode of preparing pulp for the manufacture of coffins; claiming that when prepared of the requisite thickness, saturated in oil, baked, japanned, and polished, it would resist acid, and become imperishable.

1869. The immense proportions of the paper business may be judged by the extent of the importation of rags during the year, which amounted at New York alone to 104,661 bales, valued at $2,149,202, added to which the home production must have been very large.

1870. April 6. The paper makers in the north of England held a meeting at Manchester, and agreed to advance the price of all kinds of paper ten per cent, owing to the dearness of rags.

1870. April 20. The paper makers of the United States were called upon to meet in New York to establish a union, and take measures to prevent overproduction, which, it was alleged, had reduced prices below cost. About a dozen mills only were represented, and it was resolved to call a general meeting of the trade to be held on the 20th of May.

1870. May 5. Tenney's bamboo paper mill at Bloomfield, N. J., was destroyed by fire, with all the stock and machinery. The boiler and revolving cylinder exploded, throwing fragments in every direction. Loss $100,000; mostly insured.

1870. The consumption of esparto had risen to 100,000 tons a year, yet the English cheap press was seriously annoyed by the advances in the price of paper, occasioned by the scarcity of the raw material, it was said. Low priced papers advanced a farthing a pound, and an effort was made to force the price up to a half-penny advance. The price of esparto had increased in price from £4 a ton to £10.

1870. June. The paper trade in Paris was so active that the manufacturers could not satisfy all demands, particularly for printing paper, the consumption of which was daily increasing.

1870. July. 30. The Lisbon paper mill at Lisbon Plains, burned, involving a loss of $10,000, partially insured.

1870. July 5. The boiler of D. A. Bullard & Co.'s paper mill at Schuylerville exploded, throwing portions of the boiler in different directions, and subjecting the owners to a loss of $8,000.

1870. July 9. The paper mill of Beard & Crouse, at Fayetteville, was totally destroyed by fire. Loss $25,000, of which $14,000 was insured.

1870. A paper maker in Lancashire, Eng., claimed to have succeeded in turning to profitable account particular kinds of cotton seed as a material for the manufacture of the best kinds of paper. It was supposed that the material could be procured in quantities sufficient to supply the wants of all the paper mills in the country; also to produce a fibre of the finest quality, at a price that would bring it into lively competition with esparto grass. Of all the substances hitherto suggested as a substitute for rags, the best practical judges were said to regard this as the most desirable; and as it required but little alteration in the ordinary machinery of paper mills, it was hoped that it would in a great measure overcome the difficulty of the *river pollution* caused by esparto.

1870. The paper mill at Quincy, Ill., belonging to H. A. Geis, was burnt Sept. 27, with a large stock of paper and valuable machinery. Loss estimated at $60,000, on which there was an insurance of only $7,000.

1870. There were 156 paper mills in Holland.

1870. The American Wood Paper Company at Manayunk, in Pennsylvania, introduced an important

improvement into their works, by which a saving of 85 per cent of the waste alkali solutions was recovered. The spent liquor was conducted from the pulp boiler into a suitable reservoir, and was thence pumped up into evaporating furnaces.

1870. The manufacture of paper collars in Boston, had reached during this year, 75,000,000. See 1860.

1870. The annual production of paper in France was 180 million kilogrammes, of 2 lbs. 3 oz. avoirdupois each.

1870. The *Paper Trade Reporter*, Sept. 1, 1873, reported 669 mills in the United States, producing $48,436,935.

1870. The parliamentary returns gave 344 paper mills in Great Britain, and 456 machines; namely:

England,	271	mills.	352	machines.
Scotland,	53	"	77	"
Ireland,	20	"	27	"
	344		456	

The number of persons employed was 14,547 males, 13,503 females; total 28,050.

1870. June. An injunction was obtained by the American Wood Paper Company against the Glen's Falls Paper Company, restraining them from boiling paper stuff at a certain pressure.

1870. Sponge paper, a French novelty, is said to have all the peculiarities of sponge, absorbing water readily, and remaining moist a long time. It has been used as a dressing for wounds with considerable advan-

tage. For its fabrication evenly and finely divided sponge is added to ordinary paper pulp, and this is worked, as in the common paper making apparatus, into sheets of different thickness.

1870. The alarm about the scarcity of paper fibre had now subsided, one would suppose, since in addition to the multitude of substances brought into use, *fishes* were introduced, and found to produce a pulp, which where twenty per cent of it was employed, the paper could be distinguished from the ordinary article only by its being stronger and tougher! The fish was divested of its skin and bones and placed in a diluted solution of bichloride of mercury and alum until the fibres separated.

1870. There had been a scarcity of water during the last six months of this year that proved disastrous to a great many mills throughout the country. It was stated that some mills had not made twenty tons of paper in all this time. Nevertheless, there was no lack of paper in the market, and prices remained unchanged — superfine book papers ruling at 20 to 24 cents, and fine book at 16 to 17 cents. The newspapers were mostly supplied with straw paper at 12 to 12½ cents.

1870. The *Mobile Register* was printed on paper made from the okra plant.

1870. The war in France stopped the export of fancy paper and envelopes, the consumption of which in this country was much larger this year than had been known for many years, and prices advanced

about ten per cent. The French fancy papers were almost the only thing imported that were not successfully imitated by manufacturers here. After one or two attempts to get up a really good imitation of *snow flake* and *frosted* papers, it was abandoned and the French had control of that branch of the market.

1871. John Robertson recovered $290 damages of Oliver Woodworth, at the superior court, at New London, Conn., for raising his dam by flash boards, and overflowing the plaintiff's water wheel.

1871. The long drouth of more than six months was partially relieved by rains and mild weather during the whole month of January; still the suffering was very serious among manufacturers on slender and precarious streams.

1871. The *Printer's Circular* gave the following statistics of paper mills. Similar statements are made, and seldom agree one with another. Great Britain, 408: France, 276; Germany, 243; Austria, 78; Russia, 40; Italy, 30;[1] Belgium, 26; Spain, 17; Switzerland, 14; Sweden, 8; Turkey, 1. The annual production of paper in Europe 8,956,000 cwt., valued at £15,004,400.

1871. March 23. Howard & Son's Paper Mill at Allegany City, was destroyed by fire; loss $100,000, insured $25,000.

1871. A party of Japanese on a visit to Niagara

[1] To show the unreliability of these statements, it was claimed in 1874 that Italy had 536 paper mills, manufacturing paper to the amount of 40,040,000 rames.

Falls, visited the paper mill there, and expressed their intention of taking the machinery for a manufactory home with them for the purpose of furnishing the market there, as each family made its own paper.

1871. April. Superfine book paper sold in Cincinnati and Chicago at from 16 to 18 cts. a pound, while in the eastern markets it ranged at from 20 to 24 cts.

1871. It was stated in the *Paper Trade Reporter*, that straw board, saturated with tar, was used extensively in the west for lining houses, and was effective in keeping out moisture as well as the cold blasts of winter; and that the Rock River Paper Company turned out five tons a day for the purpose without being able to supply the demand.

1871. March 20. The mill at Newbern, N. C., was burned. Loss stated at $30,000, with no insurance.

1871. March. The upper mill of Crocker, Burbank & Co., at Fitchburg, Mass., was burnt. The loss $11,300 was covered by insurance.

1871. April 17. One hundred and sixteen tons of straw, belonging to Hodgman & Palser, was burnt at their mill at Fort Edward, New York; value $3,200; insured $2000.

1871. April. The paper mill of Messrs. Bingham & Co., situated at Leesville, Conn., was burned.

1871. There were 24 paper mills in Lee, Mass., producing 50,000 pounds of paper a day. See 1851, p. 110.

1871. It was asserted in the *Paper Trade Reporter*, of May, that while the ordinary speed of the Fourdrinier machine was from 60 to 80 feet per minute on printing paper, there was one machine running at the rate of 175 feet per minute, producing 25 tons of paper weekly.

1871. May 25. The collar paper factory, operated by Mann & Laflin, at Factory Village, near Ballston, N. Y., was destroyed by fire. The mill was owned by Chauncey Cook, whose loss was $15,000, about half insured. The stock was of about equal value, insured for $6,000. The origin of the fire was unknown.

1871. The editor of the *Paper Trade Reporter* asserted that there were nearly 1,300 paper mills in the United States. The number reported in 1853, was 1,700. Perhaps neither estimate was made from sufficient investigation.

1871. The Augustine Mill of Jessup & Moore, situated near Wilmington, Delaware, and constructed of stone and iron, at a cost of $500,000, was pronounced the king mill of the world.

1871. Nearly all envelope papers, and buff papers generally were at this time made of wood pulp.

1871. The product of straw paper in the United States was estimated at 100 tons a day. Straw was scarce and high in price in the Eastern states, $25 a ton, while it could be procured in the Western states at from $1 to $4 a ton Straw news was worth in New York 12 cts. a pound, and wrapping 4½ to 5 cents.

1871. June 6. W. L. Alstyne's paper mill, at Fulton, Oswego county, was burnt.

1871. A Baltimore (Md.) firm was engaged in manufacturing paper by a new pulping process recently devised in Prussia. The invention consisted in exposing the new material, such as straw, corn leaves, etc., to the action of a weak alkaline solution, under super atmospheric pressure, and at a temperature not exceeding 2128, (*sic*) in such a manner that, by the combined action of the presure and the heat, the fibrous material is split and disintegrated without destroying the fibres, as in the case of other methods, where strong alkaline solutions and high temperatures were used.

1871. The mills of the Smith Paper Co. located at Lee, Mass., produced 14 tons of paper daily.

1871. July 10. The Unconoonuc mill at Gaffstown Centre, N. H., owned by P. C. Cheeney & Co. was destroyed by fire. Loss about $40,000; insured for $25,000.

1871. July 14. The rotary bleacher of the Howland mill at Sandy Hill, N. Y., exploded, demolishing the mill, and occasioning a loss of $15,000.

1871. July 23. A paper mill belonging to May & Rogers was burned at Lee, Mass., resulting in a loss of $15,000. It was an old mill, but had about 20 tons of paper and stock, which were burnt.

1871. July 30. The Ontario Paper Mills, at Phelps, N. Y. owned and managed by Geo. W. West, were entirely destroyed by fire, with all the machinery

and stock. Loss estimated at $21,500, with a light insurance.

1871. It was stated that a set of paper car-wheels in New Jersey had run over 100,000 miles, and entirely worn out a set of steel tires. The ordinary wheels will run 60,000 miles only.

1871. The paper mill at Glen's Falls was burnt. The machinery was saved. Loss $15,000.

1871. Lloyd, who published the *Weekly News* in London, built a paper mill to supply his establishment. He was reputed to own 180,000 acres of land in Algeria, on which he procured the esparto grass used in the manufacture of his paper, which was brought over from Africa in his own ships, and landed at his factory door on the Medway. (*Printers' Reg.*, 231.)

1871. Sept 17. A fire at Comstock's wharf, Montville, Conn., burned a large quantity of paper stock, belonging to different owners, and was valued at $14,500.

1871. A mill at Turner's Falls, Mass., manufactured pulp exclusively from poplar, the demand for which had increased to such an extent, that it was difficult to supply it. The wood was delivered at the mill in sled lengths, where it was sawed into sticks 13 inches long, stripped of its bark, split fine, and subjected to a hydraulic pressure sufficient to reduce it to the required firmness, from which it came out white and clean, but in a thick, brittle state, unfit for paper until combined with other stock. In this state it was sold to manufacturers, who mixed rags or other

material with it to suit the desired grade of paper. The mill produced from five to seven tons daily.

1871. It was stated that there were 1,200 paper mills in the United States.

1871. The government received one hundred samples of paper from Japan, mostly what is termed rice paper; which were deposited in the patent office at Washington.

1871. Oct. 30. The paper mills of Freeman & Barnett, near Fort Wayne, Ind., were burnt. Loss $35,000; insurance light.

1871. Oct. 3. F. S. Parker died at New Haven, Conn., aged 73. He was the senior partner of F. S. & J. Parker.

1871. An architect at Neustadt, Germany, by the name of Hausel, by force of necessity, made the experiment of using ordinary writing paper saturated with petroleum by means of a brush, for tracing paper, with perfect success.— *Paper Trade Reporter*, Nov. 1871.

1871. Sept. 21. A meeting of manilla paper manufacturers was held at Sandy Hill, N. Y., and adopted articles of association for the purpose of advancing prices, and governing the supply of paper.

1871. Nov. 5. The mills of the Stewart Paper Company at Brookville, Indiana, were destroyed by fire yesterday. Loss about $75,000; insured $25,000.

1871. Nov 10. The paper mill of W. W. Smith, at Seymour, Ct., was burnt. Loss $30,000.

1872. June 14. The paper mill at Ypsilanti,

Mich., owned by Cornwell & Co., was burnt. Loss $100,000, on which was an insurance of $25,000.

1872. April 30. Carey, Nash & Ogden's paper mill at Port Dickinson, N. Y., was burnt. Loss $21,000, insured $11,900.

1872. Experiments were successfully made by Stephen D. Baldwin, in California with the tules, or reed-like vegetation growing on swamp lands, the *scirpus lacustrae* of botanists, which was found to yield from fifty to sixty per cent of paper pulp: that is, equal to cotton.

1872. April 17. Hammond's paper mill at Middlebury, Vt., was burnt, at a loss of $40,000.

1872. It was stated that two hundred and sixty-three sorts of paper were manufactured at Yeddo in Japan; and that among these sorts, were some appropriated to pocket handkerchiefs, sailors' water-proof overcoats, and even sauce pans used over charcoal fires.

1872. April. The paper mill of Mullin & Parker, at Carlisle, Pa., was burnt, involving a loss of $45,000. It was the fifth fire that had occurred since the mill was first built in 1850, by Jacob Zug.

1872. April 7. John H. Taylor, of the firm of Taylor & Darrow, died, in New York (?). He was for many years engaged in the paper stock business, and was one of the first to systematize that department of trade, and reduce it to a separate and exclusive branch.

1872. May 9. The paper mill of Hodgeman & Palser, at Sandy Hill was destroyed by fire.

1872. May 16. The paper mill of C. F. Davis, at Chatham, Col. Co., N. Y., was burnt, with a large quantity of paper and straw.

1872. May 21. The mill at Union Deposit, Pa., running on manilla by W. S. Corpman, under lease of J. H. Ebersole, was burnt, at a loss of $15,000, and not rebuilt.

1872. The greatest rival of France in the manufacture of paper, was Germany; and during the invasion of the former country, the French paper makers were able to produce only small quantities of paper, and the German exports were greatly increased to Switzerland, Italy, Spain, Belgium and Holland; and it was even exported to America, India and Japan in large quantities.

1872. The number of paper mills in the United States was stated in *Lockwood's Directory* at 812, valued at $35,564,700; producing annually $66,500,000, and employing 22,000 persons.

1872. June 21. The paper mill of Elijah Smith, at Moriches, Long Island, N. Y., was burnt. Loss $75,000.

1872. June. The extensive manilla paper works of Wells, Ramsey & Co., near Rising Sun, Cecil county, Maryland, were burnt. Loss $20,000. The mill had been built only four months.

1872. A paper was made for wrapping, called iron paper, which differed from other wrapping, in having iron filings mixed in the pulp while in process of manufacture, to give it weight. It was denounced as a fraud.

1872. Epilobium, or fireweed, was looked to for paper stock.

1872. July. The Winnipiseogee paper mill at Franklin, N. H., was burnt. Loss $35,000, insured for $50,000.

1872. July 14. Davis & Moore's paper mill in Pepperell, Mass., was burned, with the stock and machinery. Loss $50,000; insured $45,000.

1872. July 19. The mill of J. B. Sheffield at Saugerties, N. Y., was burnt. The loss was $300,000; insured for $105,000. It was a very large concern, employing 150 workmen.

1872. July 19. The Albion mill at Holyoke, Mass., was ignited by the friction of the rag machine, and burnt down to the first story. Loss $50,000; insured for $67,000.

1872. The import of rags into the United States during the year ending June 3, free of duty, was 128, 280,225 lbs., of the value of $4,890,045; of these about one-half were imported from British ports.—*Paper Trade Journal.*

1872. The paper mill of F. Hendee & Co. at Council Bluffs, Iowa, was burned Aug. 30. Loss $30,000, half insured.

1872. England imported paper from the mill of Prince Bismarck at Varzin in Prussia to such an extent that it was not possible to meet the demand. This paper was made of fir.

1872. Baker's mill, Blue Store, Columbia county, N. Y., was destroyed by lightning. Loss $10,000.

1872. June 12. The Middlebrook paper mill, near Knoxville, Tenn., was burned. Loss $30,000, one-third insured.

1872. The paper mills of Bismarck at Varzin in Prussia, menufactured pasteboard from pine wood, which found a market in England. These mills wrought up 600 cords of wood per annum, but the demand being greater than the supply new works were superadded, adapted to the consumption of five cords a day.

1872. Oct. 10. The Hillsdale mill at Worthington, Iowa, was burnt. Loss, $25,000.

1872. The first news paper in Nova Scotia, was made at Bedford.— *See Paper Trade Journal, Feb.* 1, 1873.

1872. The imports of esparto into England during this year exceeded 130,000 tons. The *Times* was printed on paper made more or less of this material, as was that of most of the other leading journals, periodicals and current publications generally. The imports of paper during the first seven months of this year amounted to £124,277 in excess of those of the preceding year for the corresponding months, while the value of the exports was no less than £173,130.

1872. Oct. 25. Blauvelt & Gilmore's mill at Lee, Mass., was burned. Insured $20,000.

1872. The paper mill of Miller & Churchill at Little Falls was burnt by the explosion of a lamp.

1872. Dec. 7. The extensive paper mill of Carson & Brown, at Dalton, Mass., was burned, at a loss of

$125,000, on which were insurances to the amount of $82,500. The mill was manufacturing 2300 pounds of paper daily, of superior quality. Dec. 23. The Quinnipiac mill, near New Haven, was burnt, at a loss of $15,000. It has no facilities for putting out fires.

1872. Holyoke was the great manufacturing mart of fine writing paper, producing forty tons a day, which was three-fourths of all the product of the country at this time.

1872. Dec. 31. John Priestley died. See *Paper Trade Journal*, Jan. 15, 1873. He was the first to make a fine book paper from straw.

1872. There was reported to be in operation 812 paper mills in the United States, owned by 705 firms, and of an estimated value of $35,000,000, besides an estimated value of $43,500,000 of working capital. There were besides 39 new mills in course of construction. These 812 mills, it was stated, employed 13,420 men, 7,700 women, and 922 children; whose aggregate wages were computed at $10,000,000. The product of these mills was estimated at 317,387 tons of paper, valued at $66,575,825.— *Paper Trade Reporter*, Sept. 1, 1873, p. 5.

1873. Jan. 17. Brown & Jukes's paper mill at Amsterdam, N. Y., was burnt. Loss $20,000, insured.

1873. There were 350 paper mills in Great Britain, employing nearly 30,000 persons, and producing annually more than three hundred millions pounds of paper, according to the *Post Office Directory*.

1873. Foreign rags, three-fourths of which used to come from Italy, were now principally imported from England. The imports of rags from England in 1872, were 45,750 bales; from Italy, 23,134; from the Levant, 11,149.

1873. There being no paper mill in Greece, about 12,000 tons of rags were exported from that country, mainly to England and France.

1873. The rise of bleach, caustic and coals in England in two years, was equal to £8 1*s.* 3*d.* a ton, while the advance in the price of paper was a half a penny a pound, or about one-half the increased expense of production.

1873. The *Dundee Advertiser*, of Scotland, was printed on paper made wholly of jute, and to encourage the manufacture, the publisher offered a premium of £50 to encourage an improvement in the quality.

1873. The *New York Commercial Advertiser* says that the aggregate annual production of paper is 1,060,000 tons, of which nearly one-third, or 317,387 tons, is produced in the United States; while Germany produces 180,000 tons, and Great Britain exactly the same quantity as Germany, the French product being 148,000 tons. In the United States the number of paper mills has increased about 50 per cent since 1850 — the present number being 812, and the value of their average annual product nearly $67,000,000.

1873. A paper mill directory enumerated 812 mills in the country, and estimated the captal invested at $43,500,000. These mills employed 22,042 work-

men, and produced in the previous year 317,387 tons of paper, valued at $66,475,825.

1871. There were 22 mills in Lee, Mass., owned by nine firms, turning out 22 tons of paper daily.

1872. The losses sustained in conflagrations by paper manufacturers was one million dollars, during this year.

1873. July 10. The paper mill of Cushman Brothers at North Amherst, Mass., was burnt, involving a loss of $50,000, less $13,000 insured.

1873. The quantity of rags exported from the Turkish ports in the year 1872-3, was reported at 7,507,967 pounds by the director general of customs. — *Paper Trade Journal*, III, No. 61.

1873. In August of this year there were forty-two mills in process of construction.

1873. Messrs. Wm. Chadwick & Son, of Pendleton, England, were manufacturing paper 113 inches wide, on a 120 inch machine. The widest American machine was 96 inches.

1873. The Chilian government granted to a manufacturing firm the exclusive right to make paper in that country for news and wrapping, and laid a prohibitory duty on imports.

1873. The paper manufacturers lost by fires during this year $499,200, divided among 29 establishments. See *Paper Trade Journal* Jan. 1, 1874.

1874. The Italian mills were nearly all in charge of foreign workmen, while those in Russia were run by English hands, with the exception of a few Germans who had recently gone there.

1874. The Leipzig *Correspondent* computed the number of paper mills in the states composing the German empire at 423, a gain of 181 in six years; and the total annual product of paper at 180,000 tons.

1874. Alexander H. Rice, a Boston paper dealer, stated in a public lecture, that the quantity of paper consumed in Massachusetts was of twelve millions of dollars value, and that about three-fourths of all the paper used in the United States was produced in Massachusetts.

1874. The number of mills in the different countries in which machine-made paper was produced, and the product for the present year was estimated as follows:

	MILLS.	CWTS.
Africa,	1	5,000
Austria,	130	1,440,000
Belgium,	19	450,000
Brazil,	1	8,000
Canada,	2	10,000
Denmark,	5	72,000
France,	404	2,960,000
Germany,	423	3,600,000
Great Britain,	274	3,600,000
Holland,	10	144,000
Italy,	97	900,000
Norway and Sweden,	20	270,000
Portugal,	16	120,000
Russia,	66	670,000
Switzerland,	30	20,000(?)
Spain,	17	260,000
United States,	467	3,230,000
	1,982	17,819,000

1874. Papyrus, which was generally supposed to have become obsolete, was cultivated as a rare plant in the royal gardens at Kew, and in the Royal Society's garden, London, as well as in some private gardens in England.

1874. A canoe was constructed of paper by E. Waters and Son of Troy, N. Y. It was 14 feet in length, 28 inches in width, and 23 inches in greatest depth. It was made of linen paper, one-sixth of an inch in thickness, moulded while soft upon a solid wood form, and afterwards highly polished and varnished. It was designed for a voyage from Albany to the gulf of Mexico. Its weight was 58 lbs.

1875. Specimens of paper were exhibited to the Academy of Sciences by M. Landrin, made from gombo, a plant common to the French colonies, and in many warm countries.— *Paper Trade Journal*, April 15, 1875, p. 9.

1875. The stem of the American wild rice, *zisania aquatica*, came extensively into use as a material for paper pulp. It was said that 100,000 tons of it could be obtained annually from the shores of the Canadian lakes.— *Ibid*, p. 11.

1875. In June, there was found to be 895 mills in operation in the United States, owned by 773 firms. There were at the same time nine new mills in process of construction, although the paper business was much depressed.— *Paper Trade Journal*, IV, No. 74.

1876. The following truly *figurative* paragraph is given by way of corollary. One Carl Engel seems

to be held responsible for it. See *Printers' Circular*, XI, 183.

Of the 1,300,000,000 human beings inhabiting the globe, 360,000,000 have no paper nor writing material of any kind; 500,000,000 of the Mongolian race use a paper made from the stalks and leaves of plants; 10,000,000 use for graphic purposes tablets of wood; 130,000,000 — the Persians, Hindoos, Armenians and Syrians — have paper made from cotton, while the remaining 300,000,000 use the ordinary staple. The annual consumption by this latter number is estimated at 1,800,000,000 pounds, an average of six pounds to the person, which has increased from two and a half pounds during the last fifty years. To produce this amount of paper, 200,000,000 pounds of woolen rags, besides great quantities of linen rags, straw, wood, and other materials, are yearly consumed. The paper is manufactured in 3,960 paper mills, employing 90,000 male and 180,000 female laborers. The proportionate amounts of the different kinds of paper are stated to be: of writing paper, 300,000,000 pounds; of printing paper 900,000,000 pounds; of wall paper, 400,000,000, and 200,000,000 pounds of cartoons, blotting paper, etc.

1877. The fire king stalked abroad early in the year among the paper mills. Hammond's mill at East Pike, N. Y., producing 3500 lbs. of wrapping daily, was burned March 25. The Augustine mills near Wilmington, Delaware, owned by Jessup & Moore, and making five tons of book paper daily, was

burned April 4. Pennypacker's mill at Valley Forge Pa., having a daily capacity of 1500 lbs. of envelope paper, was burnt 8th April. The Eagle mill at Suffield, Conn., running on writing papers, and producing 800, lbs. daily, was burnt April 10. The Hudson River Paper and Pulp Co.'s mill, at Palmer Falls, N. Y., having a product of five tons of newspaper daily, was burnt on the 11th April.

1877. The number of paper mills in the United States was reckoned at 934, and the number of firms at 795, of these 254 firms and 327 mills were located in the Eastern states; 328 firms and 360 mills in the Middle states; 155 firms and 179 mills in the Western states; and 58 firms and 68 mills in the Southern states. — *Lockwood's Directory of the Paper Trade.*

FINALE.— The collector of these disjunctive conjunctives proposes, with this fifth edition, in the fifty-second year of his typographical career, to let the paper manufacture go on as it may, without any further surveillance of his, with best wishes for its prosperity to the end of time.

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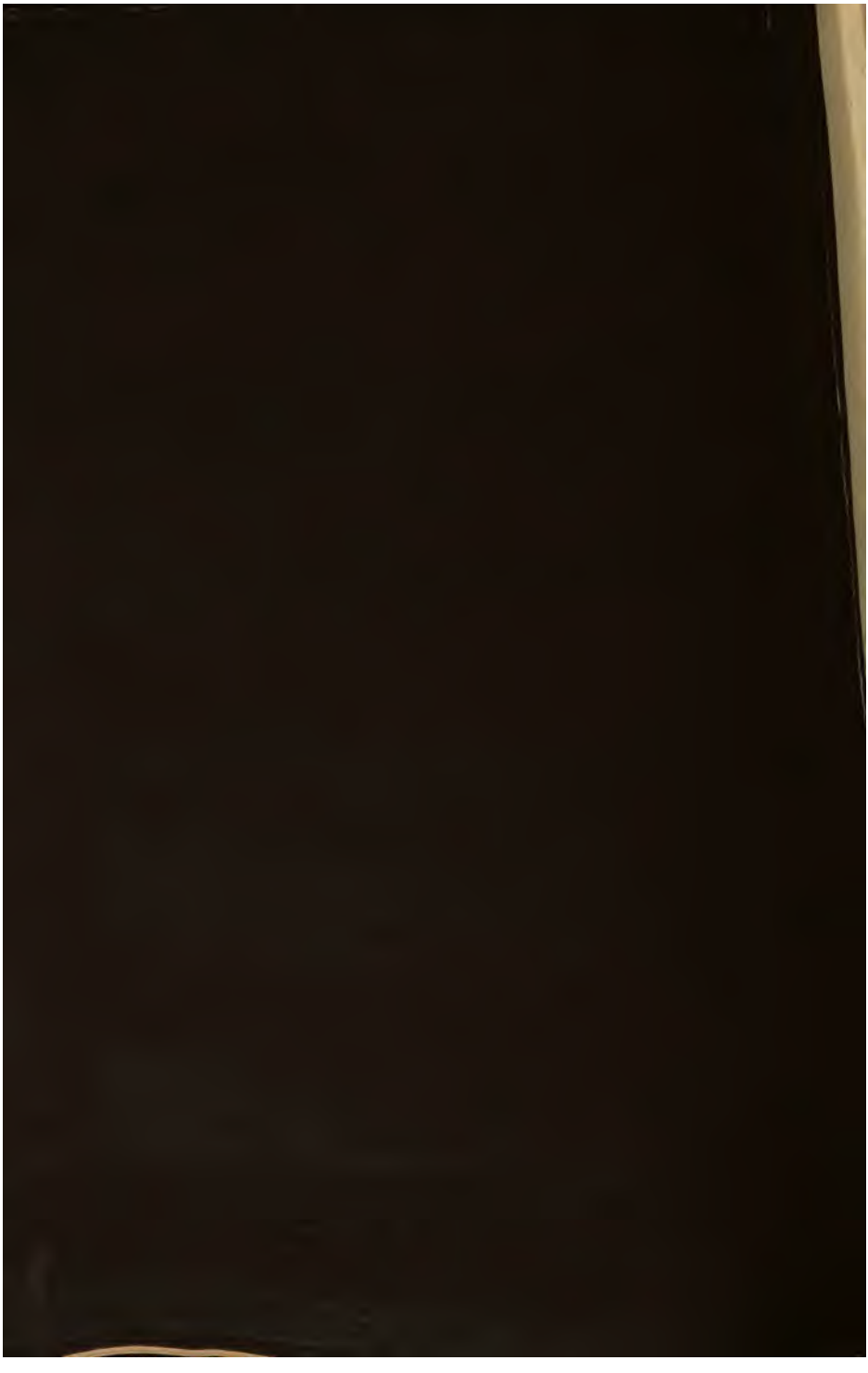

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